

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-293421  
 (43)Date of publication of application : 11.11.1997

(51)Int.CI. H01H 9/44  
 H01H 33/18  
 H01H 73/18

(21)Application number : 08-169036 (71)Applicant : MATSUSHITA ELECTRIC WORKS LTD

(22)Date of filing : 28.06.1996 (72)Inventor : TAKAYAMA SHINJI  
 OKADA TAKEHIKO  
 SHIMIZU KENICHIRO  
 KAGAWA TAKUYA

## (30)Priority

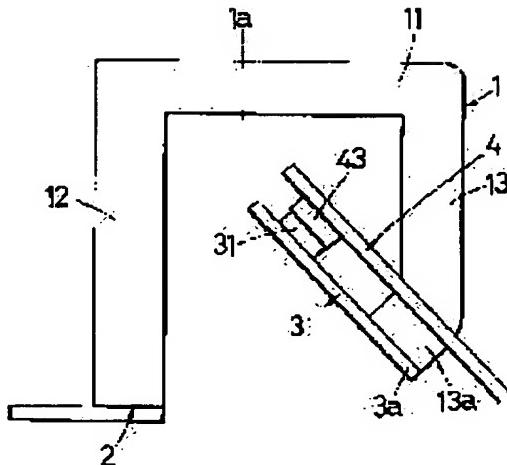
Priority number : 08 38070 Priority date : 26.02.1996 Priority country : JP

## (54) ARC-EXTINGUISHING DEVICE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an arc-extinguishing device enhancing arc-extinguishing performance by applying a strong magnetic field to an arc.

**SOLUTION:** This device comprises a coil 1 formed in almost a U shape by a first/second opposed piece 12, 13 of a plate-shaped conductor opposed to be protrusively provided from a central piece 11 and its both ends to generate a magnetic field by carrying a current, terminal plate 2 extended from a tip end of the first opposed piece 12, fixed contact plate 3 extended from a tip end of the second opposed piece 13 to a side of the first opposed piece 12 to provided a fixed contact 31 in the tip end part and a movable contact plate 4 providing in a tip end part a movable contact turned with a turn shaft positioned in a side of a base end part 3a of the fixed contact plate 3 serving as the center to make contact/separation with/from the fixed contact 31 in a U-shaped inside 1a of the coil 1. Here, in this constitution, the first opposed piece 12 is longer than the second opposed piece 13, the fixed contact plate 3 is extended from a tip end 13a of the second opposed piece 13 toward a direction of the U-shaped inside 1a of the coil 1 from a perpendicular lowered down to the first opposed piece 12.



[Claim(s)]

[Claim 1] The coil which is formed in an abbreviation KO character type by the piece of the 1st opposite and the piece of the 2nd opposite which protrude and counter from the both ends of a central piece and its central piece with a tabular conductor, and generates a magnetic field by energization, The terminal assembly which installs from the tip of the piece of the 1st opposite, and is connected with an external cable run, and the stationary-contact plate which installed from the tip of the piece of the 2nd opposite to 1st opposite one side, and prepared the stationary contact in the point, The traveling contact plate which prepared in the point the traveling contact which rotates centering on the rotation shaft located in the end face section side of a stationary-contact plate, and attaches and detaches to a stationary contact in the KO character type inside of a coil, In the circuit interrupter which drives as it is also in the magnetic field of a coil about the arc generated between the preparation and the contact, and carries out an extinction of arc, said piece of the 1st opposite is longer than said piece of the 2nd opposite. Said stationary-contact plate The circuit interrupter characterized by coming to be installed rather than the perpendicular taken down from the tip of said piece of the 2nd opposite to said piece of the 1st opposite toward the direction of the KO character type inside of said coil.

[Claim 2] It is the circuit interrupter according to claim 1 characterized by coming to install said stationary-contact plate in said piece of the 1st opposite and abbreviation parallel through the piece of middle.

[Claim 3] It is the circuit interrupter according to claim 1 characterized by coming to install said stationary-contact plate in a part or all of said central piece, and abbreviation parallel.

[Claim 4] Said traveling contact plate is a circuit interrupter according to claim 1 characterized by being formed and becoming so that it may rotate outside from the KO character type inside of said coil.

[Claim 5] The circuit interrupter according to claim 1 with which the direction of board thickness of said piece of the 2nd opposite or said piece of the 2nd opposite, and said central piece is characterized by coming to be formed perpendicularly to the rotation side of said traveling contact plate.

[Claim 6] The circuit interrupter according to claim 1 with which one of the directions of board thickness are characterized by the thing of said central piece or said piece of the 1st opposite which it comes to form perpendicularly to said rotation side at least.

[Claim 7] The circuit interrupter according to claim 1 with which the direction of board thickness of said central piece, said piece of the 1st opposite, and said piece of the 2nd opposite is characterized by coming to be formed perpendicularly to the rotation side of said traveling contact plate.

[Claim 8] Each of said central piece, said piece of the 1st opposite, said piece of the 2nd

opposite, and said terminal assembly is a circuit interrupter according to claim 1 characterized by having space in the rectangular direction of the contact side of said stationary contact, and being prepared in it.

[Claim 9] The circuit interrupter according to claim 1 with which at least one of said central piece, said piece of the 1st opposite, or said the pieces of the 2nd opposite is characterized by coming to be covered with an insulating material.

[Claim 10] Each of said stationary-contact plate and said traveling contact plate is a circuit interrupter according to claim 1 characterized by for each arc transit plate said arc runs having installed, and forming it from said each point.

[Claim 11] Said each arc transit plate is a circuit interrupter according to claim 10 characterized by preparing each notching section which met in the installation direction, respectively from the arc conglutination location where said arc agglutinates a contact edge.

[Claim 12] the opposite side [ as opposed to said stationary-contact plate side of said central piece for the electric-shielding wall which carries out an abbreviation rectangular cross with a fixed wall and its fixed wall, and covers the gas at the time of said arcing ] -- and the circuit interrupter according to claim 1 characterized by to have prepared in the opposite side to said stationary-contact plate side of said traveling contact plate, respectively, and to prepare the aeration way which was open for free passage to said KO character type inside between said electric-shielding wall and said piece of the 2nd opposite.

[Claim 13] Said electric shielding wall is a circuit interrupter according to claim 12 characterized by coming to be formed as it is also at the actuation handle which attaches and detaches said traveling contact to said stationary contact.

[Claim 14] The circuit interrupter according to claim 12 characterized by forming a septum with the opening of a predetermined dimension in each between said fixed wall and said electric shielding wall at 2nd opposite one side of said aeration way.

[Claim 15] It is the circuit interrupter according to claim 12 or 14 characterized by the thing of said electric shielding wall or said septum which either at least consists of the magnetic substance.

[Claim 16] It is the circuit interrupter according to claim 12 or 14 characterized by the thing of said electric shielding wall or said septum which it comes to cover either at least with an insulator or an insulator.

[Claim 17] Said stationary-contact plate is a circuit interrupter according to claim 1 characterized by preparing the small magnetic piece of magnetic reluctance in the location of said stationary contact.

[Claim 18] Said magnetic piece is a circuit interrupter according to claim 17 characterized by coming to be formed in the abbreviation mold for L characters with which the piece contacted

the opposite side to said stationary contact of said stationary-contact plate.

[Claim 19] Said magnetic piece is a circuit interrupter according to claim 17 characterized by it being located and coming to be formed in said terminal assembly side of said central piece.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the circuit interrupter built in the circuit breaker which protects a cable run or an external electrical machinery and apparatus from short circuit accident etc.

[0002]

[Description of the Prior Art] Conventionally, the thing of a configuration of being shown in drawing 31 and drawing 32 exists as this kind of a circuit interrupter. The coil A which this thing is formed in an abbreviation KO character type by the piece A2 of the 1st opposite and piece A3 of the 2nd opposite which protrude and counter with a tabular conductor from the both ends of the central piece A1 and its central piece A1, and generates a magnetic field by energization. The terminal assembly B which installs from the tip of the piece A2 of the 1st opposite, and is connected with an external cable run. The stationary-contact plate C which installed from the tip of piece A3 of the 2nd opposite to the piece A2 side of the 1st opposite, and formed the stationary contact C1 in the point. It has the traveling contact plate E which formed in the point the traveling contact E1 which rotates centering on the rotation shaft D located in the end face section side of the stationary-contact plate C, and attaches and detaches to a stationary contact C1 in the KO character type inside of Coil A.

[0003] A current is energized to the traveling contact plate E in more detail via the terminal assembly B connected with the external cable run, Coil A, the stationary-contact plate C, a stationary contact C1, and a traveling contact E1. When short circuit accident arises in an external cable run or an external external instrument, a short-circuit current energizes and a traveling contact E1 opens that actuation of the device section (not shown) is also.

[0004] At this time, a magnetic field is perpendicularly generated to the rotation side of the traveling contact plate E by energization of a short-circuit current which flows in Coil A in the KO character type inside of Coil A. By this magnetic field, the force of a direction of making a traveling contact E1 opening to the KO character type inside of Coil A, i.e., the Lorentz force, arises to the traveling contact plate E, and it contributes to the rise of the opening velocity of a traveling contact E1. Moreover, the arc generated between the stationary contact C1 and the contact of a traveling contact E1 receives the force which moves in the direction of a terminal assembly B, i.e., the Lorentz force, by this magnetic field. An arc is extended as it is also at this force, and arc voltage rises. And an arc is drawn in Grid F, it extends with the cooling effect of an arc, and arc voltage rises further according to effectiveness.

[0005] However, the piece A2 of the 1st opposite of this thing is the same die length as piece A3 of the 2nd opposite, and the stationary-contact plate C is not installed toward the direction of the KO character type inside of Coil A rather than the perpendicular taken down from the tip of piece A3 of the 2nd opposite to the piece A2 of the 1st opposite.

[0006] Moreover, the direction of board thickness of the central piece A and piece A3 of the 2nd opposite is level to the rotation side of the traveling contact plate E. Moreover, in order that the exhaust port of the elevated-temperature gas which occurs with an arc may be formed as it is also in the hole (not shown) of the shape of a rectangle prepared in Coil A, and it may maintain the reinforcement of Coil A, in order to suppress generation of heat of the cable run at the time of energization, a hole is made small, or width of face of Coil A is enlarged and it is prepared.

[0007] Moreover, a stationary contact C1 is bent and processed in the condition of having joined to the stationary-contact plate C, and the stationary-contact plate C, Coil A, and the terminal assembly B are formed. In this case, a stationary contact C1 may separate during bending processing, or it is sufficient for a blemish just and it may make it the front face of a stationary contact C1.

[0008]

[Problem(s) to be Solved by the Invention] In the above-mentioned conventional circuit interrupter, it drives that it is also in the magnetic field of Coil A about the arc generated between contacts, and an extinction of arc can be carried out.

[0009] However, in order to obtain the high extinction of arc engine performance, immediately after a traveling contact E1 opens with a stationary contact C1, it is necessary to impress a magnetic field strong against the arc which made quick opening velocity of a traveling contact E1 so that the arc voltage of the generated arc might be started steeply, and was generated between contacts.

[0010] This invention is what was made in view of the above-mentioned reason, and the place made into the purpose is to make contact opening velocity quick, and impress a magnetic field strong against the arc between the contacts immediately after opening, and offer the circuit interrupter which raised the extinction of arc engine performance of an arc.

[0011]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, a thing according to claim 1 The coil which is formed in an abbreviation KO character type by the piece of the 1st opposite and the piece of the 2nd opposite which protrude and counter from the both ends of a central piece and its central piece with a tabular conductor, and generates a magnetic field by energization, The terminal assembly which installs from the tip of the piece of the 1st opposite, and is connected with an external cable run, and the stationary-contact plate which installed from the tip of the piece of the 2nd opposite to 1st opposite one side, and

prepared the stationary contact in the point, The traveling contact plate which prepared in the point the traveling contact which rotates centering on the rotation shaft located in the end face section side of a stationary-contact plate, and attaches and detaches to a stationary contact in the KO character type inside of a coil, In the circuit interrupter which drives as it is also in the magnetic field of a coil about the arc generated between the preparation and the contact, and carries out an extinction of arc, said piece of the 1st opposite is longer than said piece of the 2nd opposite. Said stationary-contact plate It is made the configuration installed toward the direction of the KO character type inside of said coil rather than the perpendicular taken down from the tip of said piece of the 2nd opposite to said piece of the 1st opposite.

[0012] In the thing according to claim 1, said stationary-contact plate is made the configuration by which it was installed in said piece of the 1st opposite, and abbreviation parallel through the piece of middle for the thing according to claim 2.

[0013] The thing according to claim 3 is made the configuration by which said stationary-contact plate was installed in a part or all of said central piece, and abbreviation parallel in the thing according to claim 1.

[0014] The thing according to claim 4 is made the configuration formed so that said traveling contact plate might rotate outside from the KO character type inside of said coil in the thing according to claim 1.

[0015] The thing according to claim 5 is made the configuration in which the direction of board thickness of said piece of the 2nd opposite or said central piece, and said piece of the 2nd opposite was perpendicularly formed to the rotation side of said traveling contact plate in the thing according to claim 1.

[0016] The thing according to claim 6 is made the configuration of said central piece or said piece of the 1st opposite in which one of the directions of board thickness were perpendicularly formed to said rotation side at least in the thing according to claim 1.

[0017] The thing according to claim 7 is made the configuration in which the direction of board thickness of an account central piece, said piece of the 1st opposite, and said piece of the 2nd opposite was perpendicularly formed to the rotation side of said traveling contact plate in the thing according to claim 1.

[0018] The thing according to claim 8 is made the configuration in which each of said central piece, said piece of the 1st opposite, said piece of the 2nd opposite, and said terminal assembly was prepared by having space in the rectangular direction of the contact side of said stationary contact in the thing according to claim 1.

[0019] The thing according to claim 9 is made the configuration with which at least one of said central piece, said piece of the 1st opposite, or said the pieces of the 2nd opposite was covered with the insulating material in the thing according to claim 1.

[0020] It is made the configuration in which each arc transit plate said arc runs installed each of said stationary-contact plate and said traveling contact plate from said each point, and the thing according to claim 10 was prepared in the thing according to claim 1.

[0021] In the thing according to claim 10, said each arc transit plate is made the configuration in which each notching section which met in the installation direction was prepared, respectively for the thing according to claim 11 from the arc conglutination location where said arc agglutinates a contact edge.

[0022] The electric shielding wall which a thing according to claim 12 carries out an abbreviation rectangular cross with a fixed wall and its fixed wall in a thing according to claim 1, and covers the gas at the time of said arcing the opposite side to said stationary-contact plate side of said central piece -- and it prepares in the opposite side to said stationary-contact plate side of said traveling contact plate, respectively, and the aeration way which was open for free passage to said KO character type inside is made the configuration prepared between said electric shielding wall and said piece of the 2nd opposite.

[0023] It is made the configuration formed as a thing according to claim 13 is also at the actuation handle which said electric shielding wall attaches and detaches in said traveling contact to said stationary contact in a thing according to claim 12.

[0024] The thing according to claim 14 is made the configuration in which the septum with the opening of a predetermined dimension was formed at 2nd opposite one side of said aeration way in the thing according to claim 12 at each between said fixed wall and said electric shielding wall.

[0025] The thing according to claim 15 is made the configuration of said electric shielding wall or said septum which either at least becomes from the magnetic substance in the thing according to claim 12 or 14.

[0026] The thing according to claim 16 is made the configuration of said electric shielding wall or said septum by which either at least was covered with the insulator or the insulator in the thing according to claim 12 or 14.

[0027] The thing according to claim 17 is made the configuration with which the small magnetic piece of magnetic reluctance was prepared in the location of said stationary contact for said stationary-contact plate in the thing according to claim 1.

[0028] The thing according to claim 18 is made the configuration by which it was formed in the abbreviation mold for L characters which contacted the opposite side [ as opposed to said stationary contact of said stationary-contact plate in a piece ] for said magnetic piece in the thing according to claim 17.

[0029] The thing according to claim 19 is made the configuration in which said magnetic piece was formed by being located to said terminal assembly side of said central piece in the thing

according to claim 17.

[0030]

[Embodiment of the Invention] The 1st operation gestalt of this invention is explained below based on drawing 1 thru/or drawing 7.

[0031] It is formed in an abbreviation KO character type by the piece 12 of the 1st opposite and the piece 13 of the 2nd opposite which protrude and counter from the both ends of the central piece 11 and its central piece 11 with the conductor which 1 is a coil and consists of tabular copper or a tabular copper alloy, and the piece 12 of the 1st opposite is longer than the piece 13 of the 2nd opposite, and a magnetic field is generated in KO character type inside 1a by energization.

[0032] 2 is a terminal assembly, is installed from the tip of the piece 12 of the 1st opposite of a coil 1 to a KO character type outside, and is connected with an external cable run by the conductor which consists of tabular copper or a tabular copper alloy.

[0033] 3 is a stationary-contact plate, was installed toward the direction of KO character type inside 1a of a coil 1 rather than the perpendicular which passed through the piece 12 side of the 1st opposite from tip 13a of the piece 13 of the 2nd opposite of a coil 1 and which was taken down from tip 13a of the piece 13 of the 2nd opposite to the piece 12 of the 1st opposite with the conductor which consists of tabular copper or a tabular copper alloy, and has formed the stationary contact 31 which becomes a point from silver or a silver alloy

[0034] 4 is a traveling contact plate, it connects with the 1st link 41 whose end face section is the device section with the conductor which consists of tabular copper or a tabular copper alloy, it rotates centering on the rotation shaft 42 located in the end face section 3a side of the stationary-contact plate 3, the traveling contact 43 which becomes a point from silver or a silver alloy is formed, and this traveling contact 43 attaches and detaches a stationary contact 31 in KO character type inside 1a of a coil 1.

[0035] Actuation of this thing is explained. When short circuit accident occurs in an external cable run or an external external instrument, a short-circuit current is energized to the traveling contact plate 4 via the terminal assembly 2 connected with the external cable run, the piece 12 of the 1st opposite of a coil 1, the central piece 11, the piece 13 of the 2nd opposite, the stationary-contact plate 3, a stationary contact 31, and a traveling contact 43. Furthermore, it energizes to load side terminal assembly 10c via bimetal 10b through braided-wire 10a connected to the traveling contact plate 4. Here, the point of bimetal 10b displaces that it is also at the KO character York 10d magnetic-attraction force prepared in the method of both sides of bimetal 10b, 2nd link 10e operates, and the latch between 2nd link 10e and 3rd link 10f is opened wide.

[0036] Subsequently, the 1st link 41 4 where the traveling contact plate 4 was connected, i.e., a

traveling contact plate, rotates in KO character type inside 1a of a coil 1 centering on the rotation shaft 42, and a traveling contact 43 opens in a stationary contact 31 and the abbreviation center section of KO character type inside 1a. Furthermore, the traveling contact plate 4 rotates from KO character type inside 1a of a coil 1 to the outside of the piece 13 of the 2nd opposite.

[0037] At this time, an arc occurs between a stationary contact 31 and a traveling contact 43. Immediately after contact opening, according to the current which passes the piece 12 of the 1st opposite, the central piece 11, and the piece 13 of the 2nd opposite, a magnetic field occurs in KO character type inside 1a of a coil 1, the Lorentz force works to an arc, and an arc drives to the central piece 11 side. Since the magnetic field generated in KO character type inside 1a of a coil 1 has strongest abbreviation center section of the field surrounded by the piece 12 of the 1st opposite, the central piece 11, and the piece 13 of the 2nd opposite, i.e., the abbreviation center section inside [ KO character type ] a coil 1, this strongest magnetic field acts on an arc, an arc is elongated in response to powerful driving force, and high arc voltage is maintained.

[0038] moreover -- since the traveling contact plate 4 has the energization direction opposite to the energization direction of the stationary-contact plate 3 -- the former -- the same -- electromagnetism -- repulsive force is received. furthermore -- since it rotates centering on the rotation shaft 42 to which the traveling contact plate 4 is located in the end face section 3a side of the stationary-contact plate 3 by the magnetic field generated in KO character type inside 1a of a coil 1, the component of the energization direction is opposite to the piece 12 of the 1st opposite -- becoming -- between the pieces 12 of the 1st opposite -- electromagnetism -- repulsive force is received. since similarly the component of the energization direction is the same as that of the energization direction of the piece 13 of the 2nd opposite by the magnetic field generated in KO character type inside 1a of a coil 1 -- between the pieces 13 of the 2nd opposite -- electromagnetism -- a suction force is received.

[0039] here -- this electromagnetism -- repulsive force and electromagnetism -- since the traveling contact 43 prepared in the point of the traveling contact plate 4 attaches and detaches to a stationary contact 31 in the direction of KO character type inside 1a of a coil 1, a suction force acts in the direction which opens the traveling contact plate 4 from a stationary contact 31.

[0040] that is, the magnetic field which the traveling contact plate 4 generates in KO character type inside 1a of a coil 1 -- electromagnetism -- repulsive force and electromagnetism -- in response to a suction force, a traveling contact 43 will open with a stationary contact 31 at high speed, and arc voltage will be started steeply.

[0041] If it is in the circuit interrupter of this 1st operation gestalt, as described above, the stationary-contact plate 3 Rather than the perpendicular taken down from tip 13a of the piece 13 of the 2nd opposite to the piece 12 of the 1st opposite longer than the piece 13 of the 2nd

opposite, KO character type inside 1a of a coil 1, That is, since the magnetic field is installed toward the direction of a strong field, a magnetic field strong against the arc which the traveling contact 43 opened with the stationary contact 31, and was generated can act, an arc can develop in response to powerful driving force, and arc voltage can be raised steeply. furthermore, the magnetic field which the traveling contact plate 4 generates in KO character type inside 1a -- between the pieces 12 of the 1st opposite -- electromagnetism -- between repulsive force and the pieces 13 of the 2nd opposite -- electromagnetism -- in response to a suction force, a traveling contact 43 can open with a stationary contact 31 at high speed, and arc voltage can be started steeply.

[0042] Moreover, since the traveling contact plate 4 was formed so that it might rotate outside from KO character type inside 1a of a coil 1, the magnetic field which miniaturizes a coil 1 and is generated in KO character type inside 1a is strengthened, this strong magnetic field can be impressed to the arc generated immediately after contact opening, and powerful driving force can be given to it.

[0043] in addition -- the 1st operation gestalt -- the central piece 11 of a coil 1, the piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite -- respectively -- a part -- although formed by material, as shown in drawing 7 , at least one may be divided into two or more sections, and it is not limited.

[0044] Moreover, with the 1st operation gestalt, although each of a traveling contact 43, the traveling contact plate 4, and the stationary contact 31 and the stationary-contact plate 3 considered as another member, it may be the same member, and it is not limited.

[0045] The 2nd operation gestalt of this invention is explained below based on drawing 8 thru/or drawing 10 . In addition, with the 2nd operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and the same sign is attached about the 1st operation gestalt and the member which has the same function substantially.

[0046] 3 is a stationary-contact plate and is installed in parallel with the piece 12 of the 1st opposite toward the direction of KO character type inside 1a of a coil 1 rather than the perpendicular which passed through the piece 12 side of the 1st opposite through the piece 32 of middle from tip 13a of the piece 13 of the 2nd opposite of a coil 1 and which was taken down from tip 13a of the piece 13 of the 2nd opposite to the piece 12 of the 1st opposite with the conductor which consists of tabular copper or a tabular copper alloy.

[0047] If it is in the circuit interrupter of this 2nd operation gestalt, as described above, the stationary-contact plate 3 minds the piece of middle. Since it was installed from tip 13a of the piece 13 of the 2nd opposite in parallel with the piece 12 of the 1st opposite, the traveling contact plate 4 the magnetic field generated in KO character type inside 1a of a coil 1 -- the condition which is not parallel between the pieces 12 of the 1st opposite -- comparing -- strong

electromagnetism -- in response to repulsive force, it can open from a stationary contact 31 at high speed, and arc voltage can be started still more steeply.

[0048] In addition, with the 2nd operation gestalt, although the piece 12 of the 1st opposite and the stationary-contact plate 3 were made parallel, as shown in drawing 10, even if not completely parallel, it is not limited that what is necessary is just abbreviation parallel.

[0049] The 3rd operation gestalt of this invention is explained below based on drawing 11 and drawing 12. In addition, with the 3rd operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and the same sign is attached about the 1st operation gestalt and the member which has the same function substantially.

[0050] 1 is a coil, bending formation of the central piece 11 is carried out with the conductor which consists of tabular copper or a tabular copper alloy, and it has 1st central piece 11a and 2nd central piece 11b, and by the piece 12 of the 1st opposite and the piece 13 of the 2nd opposite which protrude and counter from the both ends of the central piece 11 and its central piece 11, it is formed in an abbreviation KO character type, and the piece 12 of the 1st opposite is long rather than the piece 13 of the 2nd opposite.

[0051] 3 is a stationary-contact plate and is installed toward the direction of KO character type inside 1a of a coil 1 in parallel with 2nd central piece 11b which is a part of central piece 11 rather than the perpendicular which passed through the piece 12 side of the 1st opposite from tip 13a of the piece 13 of the 2nd opposite of a coil 1 and which was taken down from tip 13a of the piece 13 of the 2nd opposite to the piece 12 of the 1st opposite with the conductor which consists of tabular copper or a tabular copper alloy.

[0052] If it is in the circuit interrupter of this 3rd operation gestalt, as described above, the stationary-contact plate 3 Since it was installed in 2nd central piece 11b and abbreviation parallel which are a part of central pieces 11 from tip 13a of the piece 13 of the 2nd opposite, by the magnetic field which the traveling contact plate 4 generates in KO character type inside 1a of a coil 1 the condition which is not parallel between 2nd central piece 11b -- comparing -- strong electromagnetism -- in response to a suction force, it can open from a stationary contact 31 at high speed, and arc voltage can be started still more steeply.

[0053] In addition, although the stationary-contact plate 3 considered as 2nd central piece 11b and abbreviation parallel which are a part of central pieces 11 with the 3rd operation gestalt, you may be all of the central pieces 11, and abbreviation parallel, and it is not limited.

[0054] The 4th operation gestalt of this invention is explained below based on drawing 13. In addition, with the 4th operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and the same sign is attached about the 1st operation gestalt and the member which has the same function substantially.

[0055] 1 is a coil, by the piece 12 of the 1st opposite and the piece 13 of the 2nd opposite which

protrude and counter from the both ends of the central piece 11 and its central piece 11, it is formed in an abbreviation KO character type, and the piece 12 of the 1st opposite is long rather than the piece 13 of the 2nd opposite. Here, it is formed so that the direction of board thickness of the central piece 11 and the piece 13 of the 2nd opposite may become perpendicular to the rotation side of the traveling contact plate 4.

[0056] Although it depends for the thickness of this circuit interrupter on the board width of the traveling contact plate 4, and the board width of the central piece 11 of a coil 1 located in the rotation side of the traveling contact plate 4, and the piece 13 of the 2nd opposite, since the direction of board thickness of the central piece 11 and the piece 13 of the 2nd opposite is perpendicular to the rotation side of the traveling contact plate 4, not the board width but the board thickness of the central piece 11 and the piece 13 of the 2nd opposite will develop in the rectangular direction of the rotation side. On the other hand, as shown in drawing 7, the direction of board thickness will develop [ the board width of the central piece 11 and the piece 13 of the 2nd opposite ] that it is level in the rectangular direction of the rotation side to the rotation side of the traveling contact plate 4.

[0057] The elevated-temperature gas which occurs with an arc is discharged from an exhaust port. Since arc voltage will rise if an arc is expanded in accordance with the flow of an exhaust gas, it is necessary to establish the exhaust port in the transit direction 11 of arc, i.e., central piece, and piece 12 side of the 1st opposite. Here, since the direction of board thickness of the central piece 11 is perpendicular to the rotation side of the traveling contact plate 4, elevated-temperature gas is discharged, without covering that the board width of the central piece 11 is also, even if it does not establish a hole in the central piece 11 or the piece 12 of the 1st opposite.

[0058] If it is in the circuit interrupter of this 4th operation gestalt, as described above, since the direction of board thickness of the central piece 11 of a coil 1 located in the rotation side of the traveling contact plate 4 and the piece 13 of the 2nd opposite is perpendicular to the rotation side, not the board width but the board thickness of the central piece 11 and the piece 13 of the 2nd opposite can develop in the rectangular direction of a rotation side, and thin shape-ization can be attained.

[0059] Moreover, it is discharged without covering that the elevated-temperature gas which occurs with an arc is also for the board width of the central piece 11 to the rotation side of the traveling contact plate 4, since it is perpendicular, and the direction of board thickness of the central piece 11 can form the exhaust port of elevated-temperature gas in the transit side 11 of an arc, i.e., a central piece, without establishing a hole in the central piece 11 or the piece 12 of the 1st opposite.

[0060] In addition, with the 4th operation gestalt, it formed so that the direction of board

thickness of the central piece 11 of a coil 1 and the piece 13 of the 2nd opposite might become perpendicular to the rotation side of the traveling contact plate 4, but when only the piece 13 of the 2nd opposite is located in the rotation side of the traveling contact plate 4, it is good also as perpendicular and only the piece 13 of the 2nd opposite is not limited.

[0061] Moreover, although it formed so that the direction of board thickness of the central piece 11 of a coil 1 might become perpendicular to the rotation side of the traveling contact plate 4, and the exhaust port was established in the central piece 11, it may form so that the direction of board thickness of the piece 12 of the 1st opposite may become perpendicular, and an exhaust port may be established in the piece 12 of the 1st opposite, and it is not limited.

[0062] The 5th operation gestalt of this invention is explained below based on drawing 14. In addition, with the 5th operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and the same sign is attached about the 1st operation gestalt and the member which has the same function substantially.

[0063] 1 is a coil, by the piece 12 of the 1st opposite and the piece 13 of the 2nd opposite which protrude and counter from the both ends of the central piece 11 and its central piece 11, it is formed in an abbreviation KO character type, and the piece 12 of the 1st opposite is long rather than the piece 13 of the 2nd opposite. Here, it is formed so that each direction of board thickness of the central piece 11, the piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite may become perpendicular to the rotation side of the traveling contact plate 4. Furthermore, 2nd exhaust-port 11b is prepared in the piece 12 side of the 1st opposite at the 1st exhaust-port 12a and central piece 11 side.

[0064] Actuation of this thing is explained. If a stationary contact 31 and a traveling contact 43 open, gas occurs with an arc, and since the pressure of KO character type inside 1a rises, the gas will flow toward 1st exhaust-port 12a and 2nd exhaust-port 11b which were located in the transit direction of an arc. According to the gas stream, an arc is driven and is elongated to each exhaust ports 12a and 11b or the exterior of those. Since it is easy to elongate an arc and gas flows in the arc transit direction compared with the case where there is an exhaust port only in one side since each exhaust ports 12a and 11b are established in two places, it further becomes easy to elongate.

[0065] If it is in the circuit interrupter of this 5th operation gestalt, as described above, each direction of board thickness of the central piece 11, the piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite Since it was perpendicularly formed to the rotation side of the traveling contact plate 4, two exhaust ports, without forming a hole to the central piece 11 and piece 12 side of the 1st opposite That is, it prepares in the transit direction of an arc, and thin shape-ization can be attained, while becoming easy to elongate an arc and being able to start arc voltage still more steeply compared with the case where there is an exhaust port only in one side.

[0066] The 6th operation gestalt of this invention is explained below based on drawing 15 and drawing 16. In addition, with the 5th operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and the same sign is attached about the 1st operation gestalt and the member which has the same function substantially.

[0067] Each of the central piece 11 of a coil 1, the piece 12 of the 1st opposite, the piece 13 of the 2nd opposite, and a terminal assembly 2 has space 31a in the rectangular direction of the contact side of a stationary contact 31, and is prepared in it. Furthermore, a part of central piece 11, piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite are covered with the insulating material 5 which consists of resin etc.

[0068] Bending of the conductor is carried out, where a terminal assembly 2, the piece 12 of the 1st opposite of a coil 1, the central piece 11, the piece 13 of the 2nd opposite, and the stationary-contact plate 3 are formed, the caulking rod on which the welding electrode or contact which welds a contact is closed is installed in space 31a of the rectangular direction of the 31st page of a stationary contact, and a stationary contact 31 is joined to the stationary-contact plate 3.

[0069] If it is in the circuit interrupter of this 6th operation gestalt, as described above, the central piece 11, the piece 12 of the 1st opposite, the piece 13 of the 2nd opposite, and a terminal assembly 2, respectively Since it has space in the rectangular direction of the contact side of a stationary contact 31 and was prepared in it, where it carried out bending of the conductor and a terminal assembly 2, the piece 12 of the 1st opposite of a coil 1, the central piece 11, the piece 13 of the 2nd opposite, and the stationary-contact plate 3 are formed A welding electrode or a caulking rod is installed in the space, and a stationary contact 31 can be easily joined to the stationary-contact plate 3, without a stationary contact's 31 separating during bending processing, or being sufficient for a blemish just and making it a front face.

[0070] Moreover, since a part of central piece 11, piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite are covered with the insulating material 5 which consists of resin etc., it can prevent that the arc generated after the traveling contact 43 had opened with the stationary contact 31 \*\*\*\* to the central piece 11, the piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite of a coil 1.

[0071] The 7th operation gestalt of this invention is explained below based on drawing 17 thru/or drawing 22. In addition, with the 7th operation gestalt, it supposes that a different function from the 1st operation gestalt is described, and the same sign is attached about the 1st operation gestalt and the member which has the same function substantially.

[0072] 1 is a coil, by the piece 12 of the 1st opposite and the piece 13 of the 2nd opposite which protrude and counter from the both ends of the central piece 11 and its central piece 11, it is formed in an abbreviation KO character type, and the piece 12 of the 1st opposite is formed for

a long time than the piece 13 of the 2nd opposite.

[0073] It is a stationary-contact plate, and 3 forms the stationary contact 31 which installs to the piece 12 side of the 1st opposite from the tip of the piece 13 of the 2nd opposite by which bending formation was carried out, and becomes a point from silver or a silver alloy, and the arc transit plate 33 is formed in the abbreviation mold for L characters, and it is installed and prepared from the point. Furthermore, notching section 33a meets in the installation direction from arc conglutination location 31b in a stationary contact 31, and is prepared in the arc transit plate 33. About this thing, it mentions later in detail.

[0074] It is a traveling contact plate, and 4 forms the traveling contact 43 which becomes a point from silver or a silver alloy, and the arc transit plate 44 is formed in the abbreviation mold for L characters, and it is installed and prepared from the point. Furthermore, notching section 44a meets in the installation direction from arc conglutination location 43a in a traveling contact 43, and is prepared in the arc transit plate 44.

[0075] Actuation of this thing is explained. A traveling contact 43 opens that energization of a short-circuit current is also from a stationary contact 31, and as shown in drawing 18, driving force is received in the direction where the arc generated in the stationary contact 31 intersects perpendicularly mutually by the magnetic fields Bx and By generated from the piece 13 of the 2nd opposite. Therefore, the arc which was in the abbreviation center section of the stationary contact 31 immediately after opening runs, and the guide peg is fixed in arc conglutination location 31b located in the piece 13 of the 2nd opposite and the opposite side in a point of a stationary contact 31, and it adheres.

[0076] With opening of both the contacts 31 and 43, as shown in drawing 19, the arc which adhered is elongated. Here, since the arc transit plate 33 is formed in the stationary-contact plate 3, and notching section 33a meets in the installation direction of an arc transit plate and is prepared in it from arc conglutination location 31b, the end face section of notching section 33a will be located in the core of an arc with high temperature. Therefore, while an electron becomes the heat of an arc concentrates and carries out a temperature rise to the end face section, and is easy to be emitted, electric field concentrate on the corner of notching section 33a, and the guide peg of an arc moves in the installation direction along with a corner following the end face section of notching section 44a.

[0077] The same is said of a traveling contact 43, and an arc adheres in arc conglutination location 43a located in the piece 13 of the 2nd opposite and the opposite side in a point of a traveling contact 43, and the guide peg of an arc moves it in the installation direction along with a corner following the end face section of notching section 33a.

[0078] Since each arc transit plates 33 and 44 installed and were formed from each point of the stationary-contact plate 3 and the traveling contact plate 4 as described above if it was in the

circuit interrupter of this 7th operation gestalt, as compared with the time of the arc transit plate not being formed, along with each arc transit plates 33 and 44, the arc generated between contacts can run by the ability being high-speed, and can start arc voltage steeply.

[0079] Moreover, since each notching sections 33a and 44a were formed in the installation direction along with each arc transit plates 33 and 44, respectively from each arc conglutination locations 31b and 43a If an arc drives to a driving direction, the guide peg is fixed in each conglutination locations 31b and 43a of a contact point and it adheres The end face section of each notching sections 33a and 44a will be located in the core of an arc with high temperature, a temperature rise is carried out, and an electron is emitted, and electric field concentrate on the corner, the guide peg of an arc moves in the installation direction along with a corner following the end face section, and an arc can run at high speed further.

[0080] In addition, with the 7th operation gestalt, although each of the central piece 11 of a coil 1, the piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite is formed by one piece, as shown in drawing 20 and drawing 21 , each may be formed by two pieces. Thus, when it installs to the piece 12 side of the 1st opposite from each tip 13a of one pair of pieces 13 of the 2nd opposite and the stationary-contact plate 3 is formed The arc which had an arc in the abbreviation center section of the stationary contact 31 immediately after opening in response to driving force from each of the piece 13 of the 2nd opposite whose number is one runs, and the guide peg is fixed in another arc conglutination location 31c located in the center section in the point of a stationary contact 31, and it adheres. The same is said of a traveling contact 43, therefore each notching sections 33a and 44a meet in the installation direction from another arc conglutination location, and are not limited that what is necessary is to just be prepared in the center section of each arc transit plates 33 and 44, respectively.

[0081] The 8th operation gestalt of this invention is explained below based on drawing 23 thru/or drawing 28 . In addition, with the 8th operation gestalt, it supposes that a different function from the 7th operation gestalt is described, and the same sign is attached about the 7th operation gestalt and the member which has the same function substantially.

[0082] 6 is a fixed wall, is formed in tabular with insulating resin, and forms the exhaust port 61 which protrudes from the pars basilaris ossis occipitalis of a pedestal in the opposite side to the stationary-contact plate 3 side of the central piece 11, and leads outside in the piece 12 side of the 1st opposite.

[0083] It is formed in tabular with the magnetic substance which 7 is an electric shielding wall and consists of iron or an iron alloy. An abbreviation rectangular cross is carried out with the fixed wall 6, and it is prepared in the opposite side to the stationary-contact plate 3 side of the traveling contact plate 4, the aeration way 71 is open for free passage to KO character type inside 1a, and it is formed between the pieces 13 of the 2nd opposite, and the gas which

occurred in KO character type inside 1a at the time of arcing is introduced into the aeration way 71, and covers the gas.

[0084] It is a septum, and 8 is formed in tabular by the insulator, between the fixed wall 6 and the electric shielding wall 7, it is in a condition with the 1st opening 81 and the 2nd opening 82 of a predetermined dimension, respectively, and is prepared in accordance with the electric shielding wall 7 on the aeration way 71. Moreover, the electric insulating plate 83 linked to a septum 8 was formed, and the central piece 11, the piece 12 of the 1st opposite, and the piece 13 of the 2nd opposite are covered.

[0085] Actuation of this thing is explained. An exhaust port 61 exhausts the gas which occurred in KO character type inside 1a at the time of arcing. Moreover, the device section with 2nd link 10e and 3rd link 10f and an abnormal current detecting element with bimetal 10b and KO character York 10d are prepared in the opposite side to the stationary-contact plate 3 side of the traveling contact plate 4. Therefore, the electric shielding wall 7 will protect the device section and an abnormal current detecting element from the elevated-temperature gas at the time of arcing.

[0086] An arc occurs between the contacts immediately after arcing, and the contact side of a stationary contact 31 and a traveling contact 43 is agglutinated. An arc heats the space of KO character type inside 1a, and raises a pressure. While hot gas is exhausted from an exhaust port 61 in connection with it, it passes through the 2nd opening 82 of the predetermined dimension similarly formed between the septum 8 and the electric shielding wall 7 via the 1st opening 81 of the predetermined dimension formed between the septum 8 and the fixed wall 6. That is, the 1st opening 81 and the 2nd opening 82 will form the aeration way 71.

[0087] In response to the force, it is early become easier to move in the installation direction of each arc transit plates 33 and 44 that the arc which adhered is also at the flow of this gas. If the guide peg of an arc moves to each arc transit plates 33 and 44 and both the contacts 31 and the opening distance between 43 become large, an arc will be elongated by the flow of the gas which goes to the magnetic driving force generated with a coil 1, or an exhaust port 61. Furthermore, since gas flows along the aeration way 71 from the tip of the arc transit plate 44 established in the traveling contact plate 4, as shown in drawing 25 and drawing 26, it passes along the 1st opening 81 between a septum 8 and the fixed wall 6, elongates to the 2nd opening 82 between the electric shielding wall 7 and a septum 8, and an arc is \*\*\*\*(ed) with the electric shielding wall 7.

[0088] Here, the electric shielding wall 7 consists of the magnetic substance. Therefore, the magnetic flux generated around the traveling contact plate 4 when a short-circuit current passes forms a magnetic path between the traveling contact plate 4 and magnetic substance, the magnetic-attraction force acts, and the traveling contact plate 4 is attracted by the magnetic

substance 7, i.e., an electric shielding wall.

[0089] Since the aeration way 71 which was open for free passage to KO character type inside 1a was formed between the electric shielding wall 7 and the piece 13 of the 2nd opposite as described above if it was in the circuit interrupter of this 8th operation gestalt While being covered with the electric shielding wall 7, the hot gas which occurred in KO character type inside 1a at the time of arcing Aeration is carried out along the aeration way 71 formed as it is also with the electric shielding wall 7 which carried out the abbreviation rectangular cross with the fixed wall 6 and its fixed wall 6, an arc develops in the direction met in the style of [ of gas ] aeration, arc length becomes long, and arc voltage can be started steeply.

[0090] Moreover, since the septum 8 was formed in the piece 13 side of the 2nd opposite of the aeration way 71, the 1st opening 81 and the 2nd opening 82 with a predetermined dimension become the aeration way 71 of the gas which occurred with the arc to each between the fixed wall 6 and the electric shielding wall 7, and the aeration way 71 can be formed in a predetermined dimension with a sufficient precision at it.

[0091] Moreover, since the electric shielding wall 7 consists of the magnetic substance, the magnetic flux generated around the traveling contact plate 4 when a short-circuit current passes forms a magnetic path between the traveling contact plate 4 and magnetic substance, the traveling contact plate 4 is attracted by the magnetic substance, and an opening rate can be accelerated further.

[0092] Moreover, since a septum 8 is an insulator, it can prevent that the arc elongated in the direction met in the style of [ of gas ] aeration \*\*\*\*\*, and reinforcement of the septum 8 can be carried out.

[0093] In addition, although the electric shielding wall 7 which carried out the abbreviation rectangular cross with the fixed wall 6 was established as a new member with the 8th operation gestalt, while making cost cheap, as shown in drawing 27, the electric shielding wall 7 may be formed in a stationary contact 31 as actuation handle 7a which attaches and detaches a traveling contact 43 is also, and you may use also [ stationary contact ] and it is not limited to miniaturize.

[0094] Moreover, with the 8th operation gestalt, although the septum 8 with the 1st opening 81 and the 2nd opening 82 of a predetermined dimension was formed in the aeration way 71 at each between the fixed wall 6 and the electric shielding wall 7, when there are no allowances in the tooth space which the area of the aeration way 71 installs small, it is not necessary to form a septum 8, and is not limited.

[0095] moreover -- although the electric shielding wall 7 was formed with the magnetic substance with the 8th operation gestalt -- a septum 8 -- or since the magnetic substance is in the side more near the traveling contact plate 4 compared with the case where may form a septum 8 and the electric shielding wall 7 with the magnetic substance, and only the electric shielding

wall 7 is formed with the magnetic substance at this time, the magnetic-attraction force still stronger against the traveling contact plate 4 will work.

[0096] moreover -- although the septum 8 was formed with the insulator with the 8th operation gestalt -- a septum 8 -- a metal -- forming -- an insulator -- you may cover -- the electric shielding wall 7 -- or the electric shielding wall 7 and a septum 8 may be covered and formed with an insulator or an insulator, and it is not limited.

[0097] Moreover, with the 8th operation gestalt, although the exhaust port 61 was formed in the piece 12 side of the 1st opposite, as shown in drawing 28, another exhaust port 62 which leads to the exterior and the aeration way 71 may be established in the fixed wall 6, and it is not limited that the aeration way 71 which was open for free passage to KO character type inside 1a should just be formed between the electric shielding wall 7 and the piece 13 of the 2nd opposite.

[0098] The 9th operation gestalt of this invention is explained below based on drawing 29 thru/or drawing 30. In addition, with the 9th operation gestalt, it supposes that a different function from the 7th operation gestalt is described, and the same sign is attached about the 7th operation gestalt and the member which has the same function substantially.

[0099] 9 is a magnetic piece, and with the magnetic substance which consists of iron or an iron alloy, it is formed in the abbreviation mold for L characters which consists of a piece 91 and other pieces 92 with tabular, after the other pieces 92 have contacted the side face by the side of the central piece 11 of the stationary-contact plate 3, respectively, it is fixed to the opposite side [ as opposed to the stationary contact 31 of the stationary-contact plate 3 in a piece 91 ], and both a piece 91 and the other pieces 92 are located to the terminal assembly 2 side of the central piece 11.

[0100] Actuation of this thing is explained. Passage of a short-circuit current generates magnetic flux around the stationary-contact plate 3. Since the magnetic piece 9 is formed in the location of a stationary contact 31 as shown in drawing 30, magnetic flux passes the small magnetic piece 9 of magnetic reluctance, and forms a magnetic path, namely, it carries out densification by the front-face side of a stationary contact 31. It drives that an arc is also at this magnetic flux that carried out densification in the installation direction of each arc transit plates 33 and 44.

[0101] Since the small magnetic piece 9 of magnetic reluctance was formed in the stationary-contact plate 3 in stationary-contact 31 location as described above if it was in the circuit interrupter of this 9th operation gestalt The magnetic flux generated around the stationary-contact plate 3 when a short-circuit current passes carries out densification by the front-face side of a stationary contact 31 compared with the time of the magnetic piece 9 not being formed, and driving force strong against the arc generated between contacts is given, and it can be high-speed and can be made to run an arc.

[0102] Moreover, if the piece 91 of a L character mold contacts the opposite side to the

stationary contact 31 of the stationary-contact plate 3, the heat generated in the state of energization of the rated current is emitted, and since the magnetic piece 9 was formed in the abbreviation mold for L characters, while cooling and being able to carry out the reinforcement of the stationary contact 31, the densification of the magnetic flux can be further carried out as a piece 91 and the other pieces 92 are also. Moreover, thin shape-ization can be attained, without both the piece 91 of a L character mold and the other pieces 92 projecting to the opposite side to the terminal assembly 2 side of the central piece 11, since the magnetic piece 9 was located and was formed in the terminal assembly 2 side of the central piece 11.

[0103] In addition, although the piece 91 formed the magnetic piece 9 in the abbreviation mold for L characters which contacted the opposite side to the stationary contact 31 of the stationary-contact plate 3 with the 9th operation gestalt, it may form in plate-like [ instead of a L character mold ], you may prepare in the location of a stationary contact 31, and it is not limited.

[0104]

[Effect of the Invention] A thing according to claim 1 a stationary-contact plate rather than the perpendicular taken down from the tip of the piece of the 2nd opposite to the piece of the 1st opposite longer than the piece of the 2nd opposite The KO character type inside of a coil, That is, since the magnetic field is installed toward the direction of strong field \*\*, a magnetic field strong against the arc generated from the stationary contact and the opened traveling contact can act, an arc can develop in response to powerful driving force, and arc voltage can be raised steeply. furthermore, the magnetic field which a traveling contact plate generates in the KO character type inside -- between the pieces of the 1st opposite -- electromagnetism -- between repulsive force and the pieces of the 2nd opposite -- electromagnetism -- in response to a suction force, a traveling contact can open with a stationary contact at high speed, and arc voltage can be started steeply.

[0105] Since the stationary-contact plate was installed in the piece of the 1st opposite, and abbreviation parallel from the tip of the piece of the 2nd opposite through the piece of middle in addition to the effectiveness of a thing according to claim 1, a thing according to claim 2 a traveling contact plate the magnetic field generated inside [ KO character type ] a coil -- the condition which is not parallel between the pieces of the 1st opposite -- comparing -- strong electromagnetism -- in response to repulsive force, it can open from a stationary contact at high speed, and arc voltage can be started still more steeply.

[0106] Since the stationary-contact plate was installed in the 2nd central piece and abbreviation parallel which are a part of central pieces from the tip of the piece of the 2nd opposite in addition to the effectiveness of a thing according to claim 1, a thing according to claim 3 the magnetic field which a traveling contact plate generates inside [ KO character type ] a coil -- the condition which is not parallel between the 2nd central pieces -- comparing -- strong

electromagnetism -- in response to a suction force, it can open from a stationary contact at high speed, and arc voltage can be started still more steeply.

[0107] Since the thing according to claim 4 was formed so that a traveling contact plate might rotate outside from the KO character type inside of a coil in addition to the effectiveness of a thing according to claim 1, the magnetic field which miniaturizes a coil and is generated inside [ KO character type ] a coil can become strong, and it can impress this strong magnetic field to the arc generated immediately after contact opening, and can make powerful magnetic driving force act.

[0108] Since the thing according to claim 5 has the perpendicular direction of board thickness of the piece of the 2nd opposite of a coil which is located in the rotation side of a traveling contact plate in addition to the effectiveness of a thing according to claim 1 or a central piece, and the piece of the 2nd opposite to the rotation side, not the board width but the board thickness of a central piece and the piece of the 2nd opposite can develop in the rectangular direction of a rotation side, and it can attain thin shape-ization.

[0109] a thing according to claim 6 -- the effectiveness of a thing according to claim 1 -- in addition, a central piece or the piece of the 1st opposite -- to the rotation side of a traveling contact plate, at least, since one of the directions of board thickness are perpendicular It is discharged without covering that the elevated-temperature gas which occurs with an arc is also for the board width, and the exhaust port of elevated-temperature gas can be formed in the transit side of an arc, without establishing a hole in a central piece or the piece of the 1st opposite.

[0110] A thing according to claim 7 in the effectiveness of a thing according to claim 1 In addition, a central piece, Since each direction of board thickness of the piece of the 1st opposite and the piece of the 2nd opposite was perpendicularly formed to the rotation side of a traveling contact plate Two exhaust ports are established in central one side and 1st opposite one side, i.e., the transit direction of an arc, without forming a hole, and thin shape-ization can be attained, while becoming easy to elongate an arc and being able to start arc voltage still more steeply compared with the case where there is an exhaust port only in one side.

[0111] Since in addition to the effectiveness of a thing according to claim 1 each of a central piece, the piece of the 1st opposite, the piece of the 2nd opposite, and said terminal assembly has space in the rectangular direction of the contact side of a stationary contact and was prepared in it, a thing according to claim 8 carries out bending of the conductor. Where a terminal assembly, the piece of the 1st opposite of a coil, the piece of the 2nd opposite, a central piece, and a stationary-contact plate are formed, a welding electrode or a caulking rod is installed in the space, and a stationary contact can be easily joined to a stationary-contact plate, without a stationary contact's separating during bending processing, or being sufficient for a

blemish just and making it a front face.

[0112] It can prevent the arc generated after the traveling contact had opened with the stationary contact \*\*\*\*(ing) a thing according to claim 9 to the central piece, the piece of the 1st opposite, or the piece of the 2nd opposite of a coil, since at least one of a central piece, the piece of the 1st opposite, or the pieces of the 2nd opposite is covered with the insulating material which consists of resin etc. in addition to the effectiveness of a thing according to claim 1.

[0113] Since in addition to the effectiveness of a thing according to claim 1 each arc transit plate installed and was formed from each point of a stationary-contact plate and a traveling contact plate, as compared with the time of the arc transit plate not being formed, a thing according to claim 10 can have the high-speed arc generated between contacts along with each arc transit plate, can run, and can start arc voltage steeply.

[0114] Since each notching section was prepared in the installation direction along with each arc transit plate, respectively from the arc conglutination location in addition to the effectiveness of a thing according to claim 10, a thing according to claim 11 If an arc drives to a driving direction, the guide peg is fixed in the conglutination location of a contact point and it adheres. The end face section of the notching section will be located in the core of an arc with high temperature, a temperature rise is carried out, and an electron is emitted, and electric field concentrate on the corner, the guide peg of an arc moves in the installation direction along with a corner following the end face section, and an arc can run at high speed further.

[0115] Since the aeration way which was open for free passage to the KO character type inside was prepared between the electric shielding wall and the piece of the 2nd opposite in addition to the effectiveness of a thing according to claim 1, a thing according to claim 12 While being covered with an electric shielding wall, the hot gas which occurred in the KO character type inside at the time of arcing Aeration is carried out along the aeration way formed as it is also with the electric shielding wall which carried out the abbreviation rectangular cross with a fixed wall and its fixed wall, an arc develops in the direction met in the style of [ of gas ] aeration, arc length becomes long, and arc voltage can be started steeply.

[0116] Since it was formed in addition to the effectiveness of a thing according to claim 12 that an electric shielding wall is also at an actuation handle, a thing according to claim 13 makes an electric shielding wall and an actuation handle serve a double purpose by the member of a piece, and it can miniaturize them while being able to make cost cheap.

[0117] Since the septum was formed in 2nd opposite one side of an aeration way in addition to the effectiveness of a thing according to claim 12, an opening with a predetermined dimension becomes each between a fixed wall and an electric shielding wall on the aeration way of the gas which occurred with the arc, and a thing according to claim 14 can form an aeration way in a predetermined dimension with a sufficient precision.

[0118] In addition to the effectiveness of a thing according to claim 12 or 14, the magnetic flux generated around a traveling contact plate when [ of an electric shielding wall or a septum ] a short-circuit current passes since either consists of the magnetic substance at least forms a magnetic path between the traveling contact plate and magnetic substance, a traveling contact plate is attracted by the magnetic substance, and a thing according to claim 15 can accelerate an opening rate further.

[0119] A thing according to claim 16 prevents the arc elongated in the direction of an electric shielding wall or a septum met in the style of [ of gas ] aeration since it came to cover either with an insulator or an insulator at least \*\*\*\*(ing) in addition to the effectiveness of a thing according to claim 12 or 14, and even if there are few electric shielding walls or septa, it can carry out reinforcement of either.

[0120] Since the small magnetic piece of magnetic reluctance was prepared in the stationary-contact plate in the stationary-contact location in addition to the effectiveness of a thing according to claim 1, a thing according to claim 17 The magnetic flux generated around a stationary-contact plate when a short-circuit current passes carries out densification by the front-face side of a stationary contact compared with the time of the magnetic piece not being prepared, and driving force strong against the arc generated between contacts is given, and it can be high-speed and can be made to run an arc.

[0121] If the piece of a L character mold contacts the opposite side to the stationary contact of a stationary-contact plate, a thing according to claim 18 emits the heat generated in the state of energization of the rated current, and since the magnetic piece was formed in the abbreviation mold for L characters in addition to the effectiveness of a thing according to claim 17, it can carry out densification of the magnetic flux further as a piece and other pieces are also, while cooling and being able to carry out the reinforcement of the stationary contact.

[0122] A thing according to claim 19 can attain thin shape-ization, without both the piece of the magnetic piece of a L character mold and other pieces projecting to the KO character type exterior, since the magnetic piece was located and formed in the interior of a KO character type in addition to the effectiveness of a thing according to claim 17.

[Brief Description of the Drawings]

[Drawing 1] It is the front view showing the 1st operation gestalt of this invention.

[Drawing 2] It is a front view immediately after contact opening same as the above.

[Drawing 3] It is a front view at the time of contact opening same as the above.

[Drawing 4] It is a front view after opening same as the above.

[Drawing 5] It is a perspective view same as the above.

[Drawing 6] It is the assembly drawing to a circuit breaker same as the above.

[Drawing 7] The piece of the 2nd opposite same as the above is a perspective view in the

condition of being two or more members.

[Drawing 8] It is the front view showing the 2nd operation gestalt of this invention.

[Drawing 9] It is a perspective view same as the above.

[Drawing 10] A stationary-contact plate same as the above is the front view of an abbreviation parallel condition.

[Drawing 11] It is the front view showing the 3rd operation gestalt of this invention.

[Drawing 12] It is a perspective view same as the above.

[Drawing 13] It is the front view showing the 4th operation gestalt of this invention.

[Drawing 14] It is the front view showing the 5th operation gestalt of this invention.

[Drawing 15] It is the perspective view showing the 6th operation gestalt of this invention.

[Drawing 16] It is the perspective view of a covering condition with an insulating material same as the above.

[Drawing 17] It is the perspective view showing the 7th operation gestalt of this invention.

[Drawing 18] It is a top view showing the arc conglutination location in a stationary contact same as the above.

[Drawing 19] It is a side elevation showing the expanding condition of a conglutination arc same as the above.

[Drawing 20] It is the perspective view of another example same as the above.

[Drawing 21] It is the perspective view of another example same as the above.

[Drawing 22] It is a top view showing another arc conglutination location in a stationary contact same as the above.

[Drawing 23] It is the front view showing the 8th operation gestalt of this invention.

[Drawing 24] It is a perspective view same as the above.

[Drawing 25] It is a front view showing the expanding condition of an arc same as the above.

[Drawing 26] It is a front view showing the condition that the arc same as the above developed and \*\*\*\*\*(ed).

[Drawing 27] It is the front view of another example same as the above.

[Drawing 28] It is the front view of another example same as the above.

[Drawing 29] It is the perspective view showing the 9th operation gestalt of this invention.

[Drawing 30] It is a side elevation showing the flux density of the magnetic flux generated around a fixed terminal assembly same as the above.

[Drawing 31] It is the perspective view showing the conventional example.

[Drawing 32] It is the assembly drawing to a circuit breaker same as the above.

[Description of Notations]

1 Coil

1a KO character type inside

**11 Central Piece**  
**12 Piece of 1st Opposite**  
**13 Piece of 2nd Opposite**  
**13a Tip**  
**2 Terminal Assembly**  
**3 Stationary-Contact Plate**  
**3a End face section**  
**31 Stationary Contact**  
**31a Space**  
**31b Arc conglutination location**  
**32 Piece of Middle**  
**33 Arc Transit Plate**  
**33a Notching section**  
**4 Traveling Contact Plate**  
**42 Rotation Shaft**  
**43 Traveling Contact**  
**43a Arc conglutination location**  
**44 Arc Transit Plate**  
**44a Notching section**  
**5 Insulating Material**  
**6 Fixed Wall**  
**7 Electric Shielding Wall**  
**71 Aeration Way**  
**7a Actuation handle**  
**8 Septum**  
**81 1st Opening**  
**82 2nd Opening**  
**9 Magnetic Piece**  
**91 Piece**

(19)日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開平9-293421

(43)公開日 平成9年(1997)11月11日

(51)Int.Cl.<sup>6</sup>  
H 0 1 H 9/44  
33/18  
73/18

識別記号 庁内整理番号

F I  
H 0 1 H 9/44  
33/18  
73/18

技術表示箇所  
Z  
B  
Z

審査請求 未請求 請求項の数19 O.L (全 17 頁)

(21)出願番号 特願平8-169036  
(22)出願日 平成8年(1996)6月28日  
(31)優先権主張番号 特願平8-38070  
(32)優先日 平8(1996)2月26日  
(33)優先権主張国 日本 (J P)

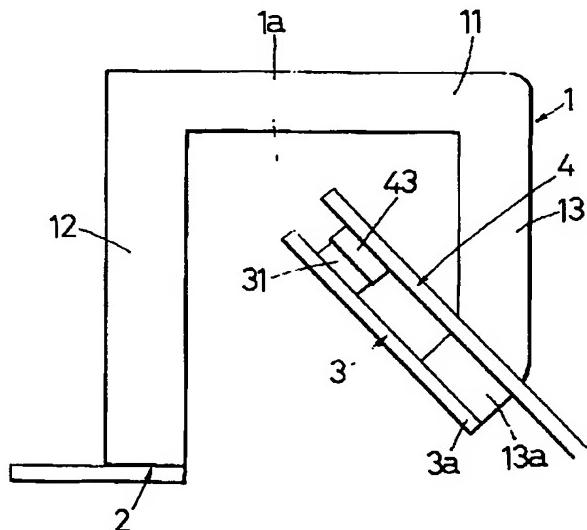
(71)出願人 000005832  
松下電工株式会社  
大阪府門真市大字門真1048番地  
(72)発明者 高山 晋治  
大阪府門真市大字門真1048番地松下電工株  
式会社内  
(72)発明者 岡田 健彦  
大阪府門真市大字門真1048番地松下電工株  
式会社内  
(72)発明者 志水憲一郎  
大阪府門真市大字門真1048番地松下電工株  
式会社内  
(74)代理人 弁理士 佐藤 成示 (外1名)  
最終頁に続く

(54)【発明の名称】 消弧装置

(57)【要約】

【課題】 アークに強い磁場を印加してアークの消弧性能を高めた消弧装置を提供する。

【解決手段】 板状の導体で中央片11とその中央片11の両端から突設して対向する第1対向片12と第2対向片13とで略コ字型に形成されて通電により磁場を発生するコイル1と、第1対向片12の先端から延設した端子板2と、第2対向片13の先端から第1対向片12側へ延設して先端部に固定接点31を設けた固定接点板3と、固定接点板3の基端部3a側に位置する回動軸を中心回動してコイル1のコ字型内側1aにて固定接点31に接離する可動接点43を先端部に設けた可動接点板4と、を備えた消弧装置において、前記第1対向片12が前記第2対向片13よりも長く、前記固定接点板3は、前記第2対向片13の先端13aから前記第1対向片12へ下ろした垂線よりも前記コイル1のコ字型内側1a方向へ向かって延設された構成にしてある。



## 【特許請求の範囲】

【請求項1】 板状の導体で中央片とその中央片の両端から突設して対向する第1対向片と第2対向片とで略コ字型に形成されて通電により磁場を発生するコイルと、第1対向片の先端から延設して外部の電路と接続される端子板と、第2対向片の先端から第1対向片側へ延設して先端部に固定接点を設けた固定接点板と、固定接点板の基礎部側に位置する回動軸を中心回動してコイルのコ字型内側にて固定接点に接離する可動接点を先端部に設けた可動接点板と、を備え、接点間に発生したアークをコイルの磁場でもって駆動して消弧する消弧装置において。

前記第1対向片が前記第2対向片よりも長く、前記固定接点板は、前記第2対向片の先端から前記第1対向片へ下ろした垂線よりも前記コイルのコ字型内側方向へ向かって延設されてなることを特徴とする消弧装置。

【請求項2】 前記固定接点板は、中間片を介して前記第1対向片と略平行に延設されてなることを特徴とする請求項1記載の消弧装置。

【請求項3】 前記固定接点板は、前記中央片の一部又は全部と略平行に延設されてなることを特徴とする請求項1記載の消弧装置。

【請求項4】 前記可動接点板は、前記コイルのコ字型内側から外側へ回動するよう形成されてなることを特徴とする請求項1記載の消弧装置。

【請求項5】 前記第2対向片又は、前記第2対向片及び前記中央片の板厚方向が、前記可動接点板の回動面に対して垂直に形成されてなることを特徴とする請求項1記載の消弧装置。

【請求項6】 前記中央片又は前記第1対向片の少なくともどちらか一方の板厚方向が、前記回動面に対して垂直に形成されてなることを特徴とする請求項1記載の消弧装置。

【請求項7】 前記中央片、前記第1対向片及び前記第2対向片の板厚方向が、前記可動接点板の回動面に対して垂直に形成されてなることを特徴とする請求項1記載の消弧装置。

【請求項8】 前記中央片、前記第1対向片、前記第2対向片及び前記端子板のそれぞれは、前記固定接点の接点面の直交方向に空間を有して設けられたことを特徴とする請求項1記載の消弧装置。

【請求項9】 前記中央片、前記第1対向片又は前記第2対向片の少なくとも一つが、絶縁物で被覆されてなることを特徴とする請求項1記載の消弧装置。

【請求項10】 前記固定接点板及び前記可動接点板のそれぞれは、前記アークが走行する各アーク走行板がそれぞれの前記先端部から延設して設けられたことを特徴とする請求項1記載の消弧装置。

【請求項11】 前記各アーク走行板は、前記アークが接点端部に膠着するアーク膠着位置から延設方向へ沿つ

た各切り欠き部がそれぞれ設けられたことを特徴とする請求項10記載の消弧装置。

【請求項12】 固定壁及びその固定壁と略直交して前記アーク発生時のガスを遮蔽する遮蔽壁を、前記中央片の前記固定接点板側に対する反対側へ及び前記可動接点板の前記固定接点板側に対する反対側へそれぞれ設け、前記コ字型内側に連通した通気路が、前記遮蔽壁及び前記第2対向片との間に設けられたことを特徴とする請求項1記載の消弧装置。

【請求項13】 前記遮蔽壁は、前記固定接点に前記可動接点を接離する操作ハンドルもって形成されてなることを特徴とする請求項12記載の消弧装置。

【請求項14】 前記固定壁及び前記遮蔽壁との間のそれぞれに所定寸法の空隙を有した隔壁が、前記通気路の第2対向片側へ設けられたことを特徴とする請求項12記載の消弧装置。

【請求項15】 前記遮蔽壁又は前記隔壁の少なくともどちらか一方は、磁性体からなることを特徴とする請求項12又は14記載の消弧装置。

【請求項16】 前記遮蔽壁又は前記隔壁の少なくともどちらか一方は、絶縁体又は絶縁体で被覆されてなることを特徴とする請求項12又は14記載の消弧装置。

【請求項17】 前記固定接点板は、磁気抵抗の小さい磁性片が前記固定接点の位置に設けられたことを特徴とする請求項1記載の消弧装置。

【請求項18】 前記磁性片は、一片が前記固定接点板の前記固定接点に対する反対側に当接した略L字型に形成されてなることを特徴とする請求項17記載の消弧装置。

【請求項19】 前記磁性片は、前記中央片の前記端子板側へ位置して形成されてなることを特徴とする請求項17記載の消弧装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、電路又は外部電気機器を短絡事故等から保護する回路遮断器等に内蔵される消弧装置に関するものである。

## 【0002】

【従来の技術】従来、この種の消弧装置として、図31及び図32に示す構成のものが存在する。このものは、板状の導体で中央片A1とその中央片A1の両端から突設して対向する第1対向片A2と第2対向片A3とで略コ字型に形成されて通電により磁場を発生するコイルAと、第1対向片A2の先端から延設して外部の電路と接続される端子板Bと、第2対向片A3の先端から第1対向片A2側へ延設して先端部に固定接点C1を設けた固定接点板Cと、固定接点板Cの基礎部側に位置する回動軸Dを中心回動してコイルAのコ字型内側にて固定接点C1に接離する可動接点E1を先端部に設けた可動接点板Eと、を備えている。

【0003】さらに詳しくは、電流は、外部の電路と接続された端子板B、コイルA、固定接点板C、固定接点C1及び可動接点E1を経由して、可動接点板Eへ通電される。外部の電路又は外部機器において短絡事故が生じた場合、短絡電流が通電されて、機構部(図示せず)の動作でもって可動接点E1が開離する。

【0004】このとき、コイルAに流れる短絡電流の通電により、磁場がコイルAのコ字型内側で可動接点板Eの回動面に対して垂直方向に生じる。この磁場により、可動接点E1をコイルAのコ字型内側へ開離させる方向の力が、すなわちローレンツ力が、可動接点板Eに生じて、可動接点E1の開離速度の上昇に寄与する。また、この磁場により、固定接点C1及び可動接点E1の接点間に発生したアークは、端子板Bの方向に移動する力を、すなわちローレンツ力を受ける。この力でもってアークが引き伸ばされて、アーク電圧が上昇する。そして、アークがグリッドF内に導かれて、アークの冷却効果と引き伸ばし効果とにより、アーク電圧がさらに上昇する。

【0005】ただし、このものは、第1対向片A2が第2対向片A3と同一長さであり、固定接点板Cは、第2対向片A3の先端から第1対向片A2へ下ろした垂線よりもコイルAのコ字型内側方向へ向かって延設されていない。

【0006】また、中央片A及び第2対向片A3の板厚方向が、可動接点板Eの回動面に対して水平である。また、アークによって発生する高温ガスの排出口が、コイルAに設けられた矩形状の穴(図示せず)でもって形成されて、コイルAの強度を保つためや通電時の電路の発熱を抑えるために、穴を小さくするか、またはコイルAの幅を大きくして設けられている。

【0007】また、固定接点C1を固定接点板Cに接合した状態で、折り曲げ加工して、固定接点板C、コイルA及び端子板Bを形成している。この場合、折り曲げ加工中に固定接点C1が剥がれたり、固定接点C1の表面に傷がついたりすることがある。

#### 【0008】

【発明が解決しようとする課題】上記した従来の消弧装置では、接点間に発生したアークをコイルAの磁場でもって駆動して消弧することができる。

【0009】しかしながら、高い消弧性能を得るために、可動接点E1が固定接点C1と開離した直後、発生したアークのアーク電圧を急峻に立ち上げるよう可動接点E1の開離速度を速くして、かつ、接点間に発生したアークに強い磁場を印加する必要がある。

【0010】本発明は、上記事由に鑑みてなしたもので、その目的とするところは、接点開離速度を速くして、かつ、開離直後の接点間のアークに強い磁場を印加して、アークの消弧性能を高めた消弧装置を提供することにある。

#### 【0011】

【課題を解決するための手段】上記した課題を解決するために、請求項1記載のものは、板状の導体で中央片とその中央片の両端から突設して対向する第1対向片と第2対向片とで略コ字型に形成されて通電により磁場を発生するコイルと、第1対向片の先端から延設して外部の電路と接続される端子板と、第2対向片の先端から第1対向片側へ延設して先端部に固定接点を設けた固定接点板と、固定接点板の基礎部側に位置する回動軸を中心に回動してコイルのコ字型内側にて固定接点に接離する可動接点を先端部に設けた可動接点板と、を備え、接点間に発生したアークをコイルの磁場でもって駆動して消弧する消弧装置において、前記第1対向片が前記第2対向片よりも長く、前記固定接点板は、前記第2対向片の先端から前記第1対向片へ下ろした垂線よりも前記コイルのコ字型内側方向へ向かって延設された構成にしてある。

【0012】請求項2記載のものは、請求項1記載のものにおいて、前記固定接点板は、中間片を介して前記第1対向片と略平行に延設された構成にしてある。

【0013】請求項3記載のものは、請求項1記載のものにおいて、前記固定接点板は、前記中央片の一部又は全部と略平行に延設された構成にしてある。

【0014】請求項4記載のものは、請求項1記載のものにおいて、前記可動接点板は、前記コイルのコ字型内側から外側へ回動するよう形成された構成にしてある。

【0015】請求項5記載のものは、請求項1記載のものにおいて、前記第2対向片又は、前記中央片及び前記第2対向片の板厚方向が、前記可動接点板の回動面に対して垂直に形成された構成にしてある。

【0016】請求項6記載のものは、請求項1記載のものにおいて、前記中央片又は前記第1対向片の少なくともどちらか一方の板厚方向が、前記回動面に対して垂直に形成された構成にしてある。

【0017】請求項7記載のものは、請求項1記載のものにおいて、記中央片、前記第1対向片及び前記第2対向片の板厚方向が、前記可動接点板の回動面に対して垂直に形成された構成にしてある。

【0018】請求項8記載のものは、請求項1記載のものにおいて、前記中央片、前記第1対向片、前記第2対向片及び前記端子板のそれぞれは、前記固定接点の接点面の直交方向に空間を有して設けられた構成にしてある。

【0019】請求項9記載のものは、請求項1記載のものにおいて、前記中央片、前記第1対向片又は前記第2対向片の少なくとも一つが、絶縁物で被覆された構成にしてある。

【0020】請求項10記載のものは、請求項1記載のものにおいて、前記固定接点板及び前記可動接点板のそれぞれは、前記アークが走行する各アーク走行板がそれ

ぞれの前記先端部から延設して設けられた構成にしてある。

【0021】請求項11記載のものは、請求項10記載のものにおいて、前記各アーク走行板は、前記アークが接点端部に膠着するアーク膠着位置から延設方向へ沿った各切り欠き部がそれぞれ設けられた構成にしてある。

【0022】請求項12記載のものは、請求項1記載のものにおいて、固定壁及びその固定壁と略直交して前記アーク発生時のガスを遮蔽する遮蔽壁を、前記中央片の前記固定接点板側に対する反対側へ及び前記可動接点板の前記固定接点板側に対する反対側へそれぞれ設け、前記コ字型内側に連通した通気路が、前記遮蔽壁及び前記第2対向片との間に設けられた構成にしてある。

【0023】請求項13記載のものは、請求項12記載のものにおいて、前記遮蔽壁は、前記固定接点に前記可動接点を接離する操作ハンドルでもって形成された構成にしてある。

【0024】請求項14記載のものは、請求項12記載のものにおいて、前記固定壁及び前記遮蔽壁との間のそれとに所定寸法の空隙を有した隔壁が、前記通気路の第2対向片側へ設けられた構成にしてある。

【0025】請求項15記載のものは、請求項12又は14記載のものにおいて、前記遮蔽壁又は前記隔壁の少なくともどちらか一方は、磁性体からなる構成にしてある。

【0026】請求項16記載のものは、請求項12又は14記載のものにおいて、前記遮蔽壁又は前記隔壁の少なくともどちらか一方は、絶縁体又は絶縁体で被覆された構成にしてある。

【0027】請求項17記載のものは、請求項1記載のものにおいて、前記固定接点板は、磁気抵抗の小さい磁性片が前記固定接点の位置に設けられた構成にしてある。

【0028】請求項18記載のものは、請求項17記載のものにおいて、前記磁性片は、一片が前記固定接点板の前記固定接点に対する反対側に当接した略し字型に形成された構成にしてある。

【0029】請求項19記載のものは、請求項17記載のものにおいて、前記磁性片は、前記中央片の前記端子板側へ位置して形成された構成にしてある。

### 【0030】

【発明の実施の形態】本発明の第1実施形態を図1乃至図7に基づいて以下に説明する。

【0031】1はコイルで、板状の銅又は銅合金からなる導体により、中央片11とその中央片11の両端から突設して対向する第1対向片12と第2対向片13とで略コ字型に形成され、第1対向片12が第2対向片13よりも長く、通電により磁場をコ字型内側1aに発生する。

【0032】2は端子板で、板状の銅又は銅合金からな

る導体により、コイル1の第1対向片12の先端からコ字型外側へ延設して、外部の電路と接続される。

【0033】3は固定接点板で、板状の銅又は銅合金からなる導体により、コイル1の第2対向片13の先端13aから第1対向片12側へ、かつ、第2対向片13の先端13aから第1対向片12へ下ろした垂線よりもコイル1のコ字型内側1a方向へ向かって延設されて、先端部に銀又は銀合金からなる固定接点31を設けている。

【0034】4は可動接点板で、板状の銅又は銅合金からなる導体により、基端部が機構部である第1リンク41に連結され、固定接点板3の基端部3a側に位置する回転軸42を中心に回動して、先端部に銀又は銀合金からなる可動接点43が設けられ、この可動接点43がコイル1のコ字型内側1aにて固定接点31と接離する。

【0035】このものの動作を説明する。外部の電路又は外部機器において短絡事故が発生したとき、短絡電流は、外部の電路と接続された端子板2、コイル1の第1対向片12、中央片11、第2対向片13、固定接点板3、固定接点31及び可動接点43を経由して、可動接点板4へ通電される。さらに、可動接点板4に接続された編組線10aを介してバイメタル10bを経由して負荷端子板10cへ通電される。ここで、バイメタル10bの両側方に設けられたコ字ヨーク10dの磁気吸引力でもって、バイメタル10bの先端部が変位して第2リンク10eが動作し、第2リンク10eと第3リンク10fとの間のラッチが開放される。

【0036】次いで、可動接点板4が連結された第1リンク41が、すなわち、可動接点板4が、回転軸42を中心にしてコイル1のコ字型内側1aにて回動して、可動接点43が固定接点31とコ字型内側1aの略中央部で開離する。さらに、可動接点板4は、コイル1のコ字型内側1aから第2対向片13の外側へ回動する。

【0037】このとき、固定接点31と可動接点43との間にアークが発生する。接点開離直後、第1対向片12、中央片11及び第2対向片13を通過する電流によって、コイル1のコ字型内側1aに磁場が発生して、アークにローレンツ力が働いて、アークが中央片11側へ駆動される。コイル1のコ字型内側1aに発生する磁場は、第1対向片12、中央片11及び第2対向片13によって囲まれる領域の略中央部が、すなわちコイル1のコ字型の内側の略中央部が、最も強いので、この最も強い磁場がアークに作用して、アークは強い駆動力を受けて伸長して、高いアーク電圧が維持される。

【0038】また、可動接点板4は、通電方向が固定接点板3の通電方向と反対であるから、従来と同様に電磁反発力を受ける。さらに、コイル1のコ字型内側1aに発生する磁場によって、可動接点板4は、固定接点板3の基端部3a側に位置する回転軸42を中心に回動するから通電方向の成分が第1対向片12と反対となって、

第1対向片12との間で電磁反発力を受ける。同様に、コイル1のコ字型内側1aに発生する磁場によって、通電方向の成分が第2対向片13の通電方向と同一であるから、第2対向片13との間で電磁吸引力を受ける。

【0039】ここで、この電磁反発力及び電磁吸引力は、可動接点板4の先端部に設けられた可動接点43がコイル1のコ字型内側1a方向にて固定接点31に接離するので、可動接点板4を固定接点31から開離する方向に作用する。

【0040】つまり、可動接点板4は、コイル1のコ字型内側1aに発生する磁場によって、電磁反発力と電磁吸引力を受けて、可動接点43が高速で固定接点31と開離してアーク電圧を急峻に立ち上げることになる。

【0041】かかる第1実施形態の消弧装置にあっては、上記したように、固定接点板3は、第2対向片13の先端13aから第2対向片13よりも長い第1対向片12へ下ろした垂線よりもコイル1のコ字型内側1a、すなわち磁場が強い領域の方向へ向かって延設されているから、可動接点43が固定接点31と開離して発生したアークに強い磁場が作用して、アークが強い駆動力を受けて伸長して、アーク電圧を急峻に上昇させることができる。さらに、可動接点板4が、コ字型内側1aに発生する磁場によって、第1対向片12との間で電磁反発力及び第2対向片13との間で電磁吸引力を受けて、可動接点43が高速で固定接点31と開離してアーク電圧を急峻に立ち上げることができる。

【0042】また、可動接点板4が、コイル1のコ字型内側1aから外側へ回動するよう形成されたから、コイル1を小型化してコ字型内側1aに発生する磁場を強くして、接点開離直後に発生するアークに、この強い磁場を印加して強い駆動力を与えることができる。

【0043】なお、第1実施形態では、コイル1の中央片11、第1対向片12及び第2対向片13のそれぞれが、一部材で形成されたものとしたが、図7に示すように、少なくとも一つが複数部に分かれてもよく、限定されない。

【0044】また、第1実施形態では、可動接点43と可動接点板4及び固定接点31と固定接点板3のそれぞれは、別の部材としたが同一部材であってもよく、限定されない。

【0045】本発明の第2実施形態を図8乃至図10に基づいて以下に説明する。なお、第2実施形態では第1実施形態と異なる機能について述べることとし、第1実施形態と実質的に同一機能を有する部材については、同一符号を付してある。

【0046】3は固定接点板で、板状の銅又は銅合金からなる導体により、コイル1の第2対向片13の先端13aから中間片32を介して第1対向片12側へ、かつ、第2対向片13の先端13aから第1対向片12へ下ろした垂線よりもコイル1のコ字型内側1a方向へ向

かって、第1対向片12と平行に延設されている。

【0047】かかる第2実施形態の消弧装置にあっては、上記したように、固定接点板3が中間片を介して、第1対向片12と平行に第2対向片13の先端13aから延設されたから、可動接点板4は、コイル1のコ字型内側1aに発生する磁場によって、第1対向片12との間で平行でない状態と比較して強い電磁反発力を受けて高速で固定接点31から開離して、アーク電圧をさらに急峻に立ち上げることができる。

【0048】なお、第2実施形態では、第1対向片12と固定接点板3とを平行としたが、図10に示すように、完全に平行でなくても略平行であればよく、限定されない。

【0049】本発明の第3実施形態を図11及び図12に基づいて以下に説明する。なお、第3実施形態では第1実施形態と異なる機能について述べることとし、第1実施形態と実質的に同一機能を有する部材については、同一符号を付してある。

【0050】1はコイルで、板状の銅又は銅合金からなる導体により、中央片11が折曲形成されて第1中央片11aと第2中央片11bとを有し、中央片11とその中央片11の両端から突設して対向する第1対向片12と第2対向片13とで略コ字型に形成され、第1対向片12が第2対向片13よりも長くなっている。

【0051】3は固定接点板で、板状の銅又は銅合金からなる導体により、コイル1の第2対向片13の先端13aから第1対向片12側へ、かつ、第2対向片13の先端13aから第1対向片12へ下ろした垂線よりもコイル1のコ字型内側1a方向へ向かって、中央片11の一部である第2中央片11bと平行に延設されている。

【0052】かかる第3実施形態の消弧装置にあっては、上記したように、固定接点板3が、中央片11の一部である第2中央片11bと略平行に第2対向片13の先端13aから延設されたから、可動接点板4が、コイル1のコ字型内側1aに発生する磁場によって、第2中央片11bとの間で平行でない状態と比較して、強い電磁吸引力を受けて高速で固定接点31から開離して、アーク電圧をさらに急峻に立ち上げることができる。

【0053】なお、第3実施形態では、固定接点板3が、中央片11の一部である第2中央片11bと略平行としたが、中央片11の全部と略平行であってもよく、限定されない。

【0054】本発明の第4実施形態を図13に基づいて以下に説明する。なお、第4実施形態では第1実施形態と異なる機能について述べることとし、第1実施形態と実質的に同一機能を有する部材については、同一符号を付してある。

【0055】1はコイルで、中央片11とその中央片11の両端から突設して対向する第1対向片12と第2対向片13とで略コ字型に形成され、第1対向片12が第

2対向片13よりも長くなっている。ここで、中央片11及び第2対向片13の板厚方向が、可動接点板4の回動面に対して垂直になるよう形成されている。

【0056】かかる消弧装置の厚さは、可動接点板4の板幅と、可動接点板4の回動面に位置するコイル1の中央片11及び第2対向片13の板幅とに依存するが、中央片11及び第2対向片13の板厚方向が、可動接点板4の回動面に対して垂直であるので、その回動面の直交方向に中央片11及び第2対向片13の板幅ではなく板厚が伸長することになる。これに対し、図7に示すように、板厚方向が、可動接点板4の回動面に対して水平であると、その回動面の直交方向に中央片11及び第2対向片13の板幅が伸長することになる。

【0057】アークによって発生する高温ガスは、排気口から排出される。その排気口は、排出ガスの流れに沿ってアークを伸長させるとアーク電圧が上昇するので、アークの走行方向、すなわち、中央片11又は第1対向片12側に設ける必要がある。ここで、中央片11の板厚方向が可動接点板4の回動面に対して垂直であるので、高温ガスは、中央片11又は第1対向片12に穴を設けなくても、中央片11の板幅でもって遮蔽されることなく排出される。

【0058】かかる第4実施形態の消弧装置にあっては、上記したように、可動接点板4の回動面に位置するコイル1の中央片11及び第2対向片13の板厚方向が、その回動面に対して垂直であるから、回動面の直交方向に中央片11及び第2対向片13の板幅ではなく板厚が伸長して、薄型化を達成することができる。

【0059】また、中央片11の板厚方向が可動接点板4の回動面に対して垂直であるから、アークによって発生する高温ガスが、中央片11の板幅でもって遮蔽されることなく排出されて、中央片11または第1対向片12に穴を設けることなく、アークの走行側に、すなわち中央片11に、高温ガスの排気口を形成することができる。

【0060】なお、第4実施形態では、コイル1の中央片11及び第2対向片13の板厚方向が、可動接点板4の回動面に対して垂直になるよう形成したが、第2対向片13のみが可動接点板4の回動面に位置するときは、第2対向片13のみを垂直としてもよく、限定されない。

【0061】また、コイル1の中央片11の板厚方向が、可動接点板4の回動面に対して垂直になるよう形成して中央片11に排気口を設けたが、第1対向片12の板厚方向が垂直になるよう形成して、排気口を第1対向片12に設けてもよく、限定されない。

【0062】本発明の第5実施形態を図14に基づいて以下に説明する。なお、第5実施形態では第1実施形態と異なる機能について述べることとし、第1実施形態と実質的に同一機能を有する部材については、同一符号を

付してある。

【0063】1はコイルで、中央片11とその中央片11の両端から突設して対向する第1対向片12と第2対向片13とで略コ字型に形成され、第1対向片12が第2対向片13よりも長くなっている。ここで、中央片11、第1対向片12及び第2対向片13のそれぞれの板厚方向が、可動接点板4の回動面に対して垂直になるよう形成されている。さらに、第1対向片12側に第1排気口12a及び中央片11側に第2排気口11bを設けている。

【0064】このものの動作を説明する。固定接点31と可動接点43とが開離すると、アークによってガスが発生して、そのガスはコ字型内側1aの圧力が上昇するので、アークの走行方向に位置した第1排気口12a及び第2排気口11bへ向かって流れる。そのガス流によってアークは駆動されて、各排気口12a、11b又はその外部まで伸長する。2箇所に各排気口12a、11bが設けられているので、一方のみに排気口がある場合と比べて、アークが伸長しやすく、またアーク走行方向へガスが流れるのでさらに伸長しやすくなる。

【0065】かかる第5実施形態の消弧装置にあっては、上記したように、中央片11、第1対向片12及び第2対向片13のそれぞれの板厚方向が、可動接点板4の回動面に対して垂直に形成されたから、穴を形成せずに2箇所の排気口を中央片11側及び第1対向片12側へ、つまりアークの走行方向へ設けて、一方のみに排気口がある場合と比べて、アークが伸長しやすくなって、アーク電圧をさらに急峻に立ち上げることができるとともに、薄型化を達成できる。

【0066】本発明の第6実施形態を図15及び図16に基づいて以下に説明する。なお、第5実施形態では第1実施形態と異なる機能について述べることとし、第1実施形態と実質的に同一機能を有する部材については、同一符号を付してある。

【0067】コイル1の中央片11、第1対向片12、第2対向片13及び端子板2のそれらが、固定接点31の接点面の直交方向に空間31aを有して設けられている。さらに、中央片11、第1対向片12の一部及び第2対向片13が、樹脂等からなる絶縁物5で被覆されている。

【0068】導体を曲げ加工して、端子板2、コイル1の第1対向片12、中央片11、第2対向片13及び固定接点板3を形成した状態で、接点を溶接する溶接用電極又は接点をかしめるかしめ棒を固定接点31面の直交方向の空間31aに設置して、固定接点31を固定接点板3に接合する。

【0069】かかる第6実施形態の消弧装置にあっては、上記したように、中央片11、第1対向片12、第2対向片13及び端子板2のそれらが、固定接点31の接点面の直交方向に空間を有して設けられたから、導

体を曲げ加工して、端子板2、コイル1の第1対向片12、中央片11、第2対向片13及び固定接点板3を形成した状態で、溶接用電極又はかしめ棒をその空間に設置して、折り曲げ加工中に固定接点31が剥がれたり表面に傷がついたりすることなく、固定接点31を固定接点板3に容易に接合することができる。

【0070】また、中央片11、第1対向片12の一部及び第2対向片13が、樹脂等からなる絶縁物5で被覆されているから、可動接点43が固定接点31と開離した状態で発生したアークがコイル1の中央片11、第1対向片12及び第2対向片13に矯絡することを防止することができる。

【0071】本発明の第7実施形態を図17乃至図22に基づいて以下に説明する。なお、第7実施形態では第1実施形態と異なる機能について述べることとし、第1実施形態と実質的に同一機能を有する部材については、同一符号を付してある。

【0072】1はコイルで、中央片11とその中央片11の両端から突設して対向する第1対向片12と第2対向片13とで略コ字型に形成され、第1対向片12が第2対向片13よりも長く形成されている。

【0073】3は固定接点板で、折曲形成された第2対向片13の先端から第1対向片12側へ延設して先端部に銀又は銀合金からなる固定接点31を設け、アーク走行板33が略L字型に形成され、先端部から延設して設けられている。さらに、切り欠き部33aが、固定接点31におけるアーク膠着位置31bから延設方向へ沿ってアーケ走行板33に設けられている。このものについては、詳しく後述する。

【0074】4は可動接点板で、先端部に銀又は銀合金からなる可動接点43を設け、アーク走行板44が略L字型に形成され、先端部から延設して設けられている。さらに、切り欠き部44aが、可動接点43におけるアーク膠着位置43aから延設方向へ沿ってアーケ走行板44に設けられている。

【0075】このものの動作を説明する。短絡電流の通電でもって可動接点43が固定接点31から開離して、図18に示すように、固定接点31に発生したアークが、第2対向片13から発生する磁場Bx, Byによって、互いに直交する方向へ駆動力を受ける。したがって、開離直後に固定接点31の略中央部にあったアークは走行して、その足が固定接点31の先端部における第2対向片13と反対側に位置するアーク膠着位置31bにて、固定されて膠着する。

【0076】両接点31, 43の開離にともない、図19に示すように、膠着したアークは伸長する。ここで、固定接点板3にアーケ走行板33が設けられて、切り欠き部33aがアーケ走行板33からアーケ走行板の延設方向へ沿って設けられているので、切り欠き部33aの基端部が温度の高いアークの中心部に位置すること

になる。したがって、その基端部にアークの熱が集中し温度上昇して電子が放出されやすくなるとともに、電界が切り欠き部33aの角部に集中して、アークの足が切り欠き部44aの基端部につづいて角部に沿って延設方向へ移動する。

【0077】可動接点43についても同様であって、アークは可動接点43の先端部における第2対向片13と反対側に位置するアーク膠着位置43aにて膠着し、アークの足が切り欠き部33aの基端部につづいて角部に沿って延設方向へ移動する。

【0078】かかる第7実施形態の消弧装置にあっては、上記したように、各アーク走行板33, 44が固定接点板3及び可動接点板4のそれぞれの先端部から延設して設けられたから、アーク走行板が設けられていないときと比較して、接点間に発生したアークが各アーク走行板33, 44に沿って高速度で走行して、アーク電圧を急峻に立ち上げることができる。

【0079】また、各切り欠き部33a, 44aが各アーク走行板33, 44に各アーク膠着位置31b, 43aから延設方向へ沿ってそれぞれ設けられたから、アークが駆動方向へ駆動されて、その足が接点先端部の各膠着位置31b, 43aにて固定されて膠着すると、各切り欠き部33a, 44aの基端部が温度の高いアークの中心部に位置することになって温度上昇し電子を放出して、かつ電界がその角部に集中して、アークの足が基端部につづいて角部に沿って延設方向へ移動して、アークがさらに高速度で走行できる。

【0080】なお、第7実施形態では、コイル1の中央片11、第1対向片12及び第2対向片13のそれぞれを1個で形成したが、図20及び図21に示すように、それぞれが2個で形成される場合がある。このように、1対の第2対向片13のそれぞれの先端13aから第1対向片12側へ延設して固定接点板3が設けられたときは、アークが1対の第2対向片13のそれぞれから駆動力を受けて、開離直後固定接点31の略中央部にあったアークは走行して、その足が固定接点31の先端部における中央部に位置する別のアーク膠着位置31cにて固定されて膠着する。可動接点43についても同様であって、したがって、各切り欠き部33a, 44aが別のアーク膠着位置から延設方向へ沿って、各アーク走行板33, 44の中央部にそれぞれ設けられればよく、限定されない。

【0081】本発明の第8実施形態を図23乃至図28に基づいて以下に説明する。なお、第8実施形態では第7実施形態と異なる機能について述べることとし、第7実施形態と実質的に同一機能を有する部材については、同一符号を付してある。

【0082】6は固定壁で、絶縁性の樹脂により、板状に形成され、中央片11の固定接点板3側に対する反対側にて基台の底部から突設し、第1対向片12側にて外

部に通じる排気口61を形成している。

【0083】7は遮蔽壁で、鉄又は鉄合金からなる磁性体により、板状に形成され、固定壁6と略直交して可動接点板4の固定接点板3側に対する反対側へ設けられ、通気路71がコ字型内側1aに連通して第2対向片13との間に形成され、アーク発生時にコ字型内側1aで発生したガスが通気路71に導入されて、そのガスを遮蔽する。

【0084】8は隔壁で、絶縁体により、板状に形成され、固定壁6及び遮蔽壁7との間にそれぞれ所定寸法の第1空隙81及び第2空隙82を有した状態で、遮蔽壁7に沿って通気路71に設けられている。また、隔壁8に接続した絶縁板83が設けられ、中央片11、第1対向片12及び第2対向片13を被覆している。

【0085】このものの動作を説明する。排気口61がアーク発生時にコ字型内側1aで発生したガスを排気する。また、第2リンク10e及び第3リンク10fを有した機構部と、バイメタル10b及びコ字ヨーク10dを有した異常電流検出部とが、可動接点板4の固定接点板3側に対する反対側へ設けられている。したがって、遮蔽壁7が機構部及び異常電流検出部を、アーク発生時の高温ガスから保護することになる。

【0086】アーク発生直後、接点間にアークが発生して、固定接点31及び可動接点43の接点間に膠着する。アークは、コ字型内側1aの空間を加熱して圧力を上昇させる。それに伴い、高温のガスは排気口61から排気されるとともに、隔壁8と固定壁6との間に形成された所定寸法の第1空隙81を経由して、同様に隔壁8と遮蔽壁7との間に形成された所定寸法の第2空隙82を通過する。すなわち、第1空隙81及び第2空隙82が通気路71を形成することになる。

【0087】膠着したアークは、このガスの流れでもって、各アーク走行板33, 44の延設方向へ力を受けてより早く移動し易くなる。アークの足が各アーク走行板33, 44に移動して、両接点31, 43間の開極距離が大きくなると、コイル1によって発生する磁気駆動力や排気口61に向かうガスの流れによって、アークは伸長する。さらに、ガスが可動接点板4に設けられたアーク走行板44の先端から通気路71に沿って流れるので、図25及び図26に示すように、アークは、隔壁8と固定壁6間の第1空隙81を通って、遮蔽壁7と隔壁8間の第2空隙82まで伸長して、遮蔽壁7で矯結する。

【0088】ここで、遮蔽壁7が磁性体で構成されている。したがって、短絡電流が通過したとき可動接点板4の回りに発生する磁束が、その可動接点板4と磁性体との間に磁路を形成し磁気吸引力が作用して、可動接点板4が磁性体、つまり遮蔽壁7に吸引される。

【0089】かかる第8実施形態の消弧装置にあっては、上記したように、コ字型内側1aに連通した通気路

71が遮蔽壁7及び第2対向片13との間に設けられたから、アーク発生時にコ字型内側1aにて発生した高温のガスが、遮蔽壁7で遮蔽されるとともに、固定壁6とその固定壁6と略直交した遮蔽壁7とでもって形成された通気路71に沿って通気して、アークがガスの通気流に沿った方向で伸長しアーク長さが長くなって、アーク電圧を急峻に立ち上げることができる。

【0090】また、隔壁8が通気路71の第2対向片13側へ設けられたから、固定壁6及び遮蔽壁7との間のそれぞれに所定寸法を有した第1空隙81及び第2空隙82がアークによって発生したガスの通気路71になって、通気路71を所定寸法に精度よく形成することができる。

【0091】また、遮蔽壁7が磁性体からなるから、短絡電流が通過したとき可動接点板4の回りに発生する磁束が、その可動接点板4と磁性体との間に磁路を形成して、可動接点板4が磁性体に吸引されて、開極速度をさらに高速化することができる。

【0092】また、隔壁8が絶縁体であるから、ガスの通気流に沿った方向で伸長したアークが矯結することを防止して、隔壁8を長寿命化することができる。

【0093】なお、第8実施形態では、固定壁6と略直交した遮蔽壁7を新規部材として設けたが、コストを安価にするとともに小型化したいときは、図27に示すように、固定接点31に可動接点43を接離する操作ハンドル7aでもって遮蔽壁7を形成して兼用してもよく、限定されない。

【0094】また、第8実施形態では、固定壁6及び遮蔽壁7との間のそれぞれに所定寸法の第1空隙81及び第2空隙82を有した隔壁8を通気路71に設けたが、通気路71の面積が小さく設置するスペースに余裕がないときは隔壁8を設けなくともよく、限定されない。

【0095】また、第8実施形態では、遮蔽壁7を磁性体で形成したが、隔壁8を又は隔壁8と遮蔽壁7とを磁性体で形成してもよく、このとき、遮蔽壁7だけが磁性体で形成されている場合に比べて、磁性体がより可動接点板4に近い側にあるので、可動接点板4にさらに強い磁気吸引力が働くことになる。

【0096】また、第8実施形態では、隔壁8を絶縁体で形成したが、隔壁8を金属で形成して絶縁体で被覆してもよく、遮蔽壁7を又は遮蔽壁7と隔壁8とを、絶縁体又は絶縁体で被覆して形成してもよく、限定されない。

【0097】また、第8実施形態では、第1対向片12側へ排気口61を形成したが、図28に示すように、外部及び通気路71に通じる別の排気口62を固定壁6に設けてもよく、コ字型内側1aに連通した通気路71が遮蔽壁7及び第2対向片13との間に設けられていればよく、限定されない。

【0098】本発明の第9実施形態を図29乃至図30

に基づいて以下に説明する。なお、第9実施形態では第7実施形態と異なる機能について述べることとし、第7実施形態と実質的に同一機能を有する部材については、同一符号を付してある。

【0099】9は磁性片で、鉄又は鉄合金からなる磁性体により、板状で一片91と他片92からなる略L字型に形成され、一片91が固定接点板3の固定接点31に対する反対側へ、他片92が固定接点板3の中央片11側の側面にそれぞれ当接した状態で固定されて、一片91と他片92との両方が中央片11の端子板2側へ位置している。

【0100】このものの動作を説明する。短絡電流が通過すると固定接点板3の回りに磁束が発生する。磁束は、図30に示すように、固定接点31の位置に磁性片9が設けられているので、磁気抵抗の小さい磁性片9を通過して磁路を形成して、すなわち、固定接点31の表面側で高密度化する。アークは、この高密度化した磁束でもって、各アーク走行板33、44の延設方向へ駆動される。

【0101】かかる第9実施形態の消弧装置にあっては、上記したように、磁気抵抗の小さい磁性片9が固定接点31位置にて固定接点板3に設けられたから、短絡電流が通過したとき固定接点板3の回りに発生する磁束が、磁性片9が設けられていないときと比べて、固定接点31の表面側で高密度化して、接点間に発生したアークに強い駆動力を与えて、高速度でアークを走行させることができる。

【0102】また、磁性片9が略L字型に形成されたから、L字型の一片91が固定接点板3の固定接点31に対する反対側に当接すると、定格電流の通電状態で発生する熱を発散して、固定接点31を冷却し長寿命化できるとともに、一片91と他片92とでもってさらに磁束を高密度化できる。また、磁性片9が中央片11の端子板2側へ位置して形成されたから、L字型の一片91及び他片92の両方が中央片11の端子板2側に対する反対側へ突出することなく、薄型化を達成することができる。

【0103】なお、第9実施形態では、磁性片9を一片91が固定接点板3の固定接点31に対する反対側に当接した略L字型に形成したが、L字型でなく平板状に形成して固定接点31の位置に設けてもよく、限定されない。

#### 【0104】

【発明の効果】請求項1記載のものは、固定接点板は、第2対向片の先端から第2対向片よりも長い第1対向片へ下ろした垂線よりもコイルのコ字型内側、すなわち磁場が強い領域、の方向へ向かって延設されているから、固定接点と開離した可動接点から発生したアークに強い磁場が作用して、アークが強い駆動力を受けて伸長して、アーク電圧を急峻に上昇させることができる。さら

に、可動接点板が、コ字型内側に発生する磁場によって、第1対向片との間で電磁反発力及び第2対向片との間で電磁吸引力を受けて、可動接点が高速で固定接点と開離してアーク電圧を急峻に立ち上げることができる。

【0105】請求項2記載のものは、請求項1記載のものの効果に加えて、固定接点板が中間片を介して第1対向片と略平行に第2対向片の先端から延設されたので、可動接点板は、コイルのコ字型内側に発生する磁場によって、第1対向片との間で平行でない状態と比較して、強い電磁反発力を受けて高速で固定接点から開離して、アーク電圧をさらに急峻に立ち上げることができる。

【0106】請求項3記載のものは、請求項1記載のものの効果に加えて、固定接点板が、中央片の一部である第2中央片と略平行に第2対向片の先端から延設されたので、可動接点板が、コイルのコ字型内側に発生する磁場によって、第2中央片との間で平行でない状態と比較して強い電磁吸引力を受けて高速で固定接点から開離して、アーク電圧をさらに急峻に立ち上げることができる。

【0107】請求項4記載のものは、請求項1記載のものの効果に加えて、可動接点板が、コイルのコ字型内側から外側へ回動するよう形成されたから、コイルを小型化してコイルのコ字型内側に発生する磁場が強くなり、接点開離直後に発生するアークに、この強い磁場を印加して強い磁気駆動力を作用させることができる。

【0108】請求項5記載のものは、請求項1記載のものの効果に加えて、可動接点板の回動面に位置するコイルの第2対向片、又は中央片と第2対向片の板厚方向が、その回動面に対して垂直であるから、回動面の直交方向に中央片及び第2対向片の板幅ではなく板厚が伸長して、薄型化を達成することができる。

【0109】請求項6記載のものは、請求項1記載のものの効果に加えて、中央片又は第1対向片の少なくともどちらか一方の板厚方向が可動接点板の回動面に対して垂直であるから、アークによって発生する高温ガスが、板幅でもって遮蔽されることなく排出されて、中央片または第1対向片に穴を設けることなく、アークの走行側に高温ガスの排気口を形成することができる。

【0110】請求項7記載のものは、請求項1記載のものの効果に加えて、中央片、第1対向片及び第2対向片のそれぞれの板厚方向が、可動接点板の回動面に対して垂直に形成されたから、穴を形成せずに2箇所の排気口を中央片側及び第1対向片側へ、つまりアークの走行方向へ設けて、一方のみに排気口がある場合と比べて、アークが伸長しやすくなって、アーク電圧をさらに急峻に立ち上げることができるとともに、薄型化を達成できる。

【0111】請求項8記載のものは、請求項1記載のものの効果に加えて、中央片、第1対向片、第2対向片及び前記端子板のそれぞれが、固定接点の接点面の直交方

向に空間を有して設けられたから、導体を曲げ加工して、端子板、コイルの第1対向片、第2対向片、中央片、固定接点板を形成した状態で、溶接用電極又はかしめ棒をその空間に設置して、折り曲げ加工中に固定接点が剥がれたり表面に傷がついたりすることなく、固定接点を固定接点板に容易に接合することができる。

【0112】請求項9記載のものは、請求項1記載のものの効果に加えて、中央片、第1対向片又は第2対向片の少なくとも一つが、樹脂等からなる絶縁物で被覆されているから、可動接点が固定接点と開離した状態で発生したアークが、コイルの中央片、第1対向片又は第2対向片へ矯絡することを防ぐことができる。

【0113】請求項10記載のものは、請求項1記載のものの効果に加えて、各アーク走行板が固定接点板及び可動接点板のそれぞれの先端部から延設して設けられたから、アーク走行板が設けられていないときと比較して、接点間に発生したアークが各アーク走行板に沿って高速度で走行して、アーク電圧を急峻に立ち上げることができる。

【0114】請求項11記載のものは、請求項10記載のものの効果に加えて、各切り欠き部が各アーク走行板にアーク膠着位置から延設方向へ沿ってそれぞれ設けられたから、アークが駆動方向へ駆動されて、その足が接点先端部の膠着位置にて固定されて膠着すると、切り欠き部の基端部が温度の高いアークの中心部に位置することになって温度上昇し電子を放出して、かつ電界がその角部に集中して、アークの足が基端部につづいて角部に沿って延設方向へ移動して、アークがさらに高速度で走行できる。

【0115】請求項12記載のものは、請求項1記載のものの効果に加えて、コ字型内側に連通した通気路が遮蔽壁及び第2対向片との間に設けられたから、アーク発生時にコ字型内側にて発生した高温のガスが、遮蔽壁で遮蔽されるとともに、固定壁とその固定壁と略直交した遮蔽壁とでもって形成された通気路に沿って通気して、アークがガスの通気流に沿った方向で伸長しアーク長さが長くなつて、アーク電圧を急峻に立ち上げることができる。

【0116】請求項13記載のものは、請求項12記載のものの効果に加えて、遮蔽壁が操作ハンドルでもって形成されたから、遮蔽壁と操作ハンドルとを一個の部材で兼用して、コストを安価にできるとともに小型化することができる。

【0117】請求項14記載のものは、請求項12記載のものの効果に加えて、隔壁が通気路の第2対向片側へ設けられたから、固定壁及び遮蔽壁との間のそれぞれに所定寸法を有した空隙がアークによって発生したガスの通気路になつて、通気路を所定寸法に精度よく形成することができる。

【0118】請求項15記載のものは、請求項12又は

14記載のものの効果に加えて、遮蔽壁又は隔壁の少なくともどちらか一方が磁性体からなるから、短絡電流が通過したとき可動接点板の回りに発生する磁束が、その可動接点板と磁性体との間に磁路を形成して、可動接点板が磁性体に吸引されて、開極速度をさらに高速化することができる。

【0119】請求項16記載のものは、請求項12又は14記載のものの効果に加えて、遮蔽壁又は隔壁の少なくともどちらか一方が絶縁体又は絶縁体で被覆されてなるから、ガスの通気流に沿った方向で伸長したアークが矯絡することを防いで、遮蔽壁又は隔壁の少なくともどちらか一方を長寿命化することができる。

【0120】請求項17記載のものは、請求項1記載のものの効果に加えて、磁気抵抗の小さい磁性片が固定接点位置にて固定接点板に設けられたから、短絡電流が通過したとき固定接点板の回りに発生する磁束が、磁性片が設けられていないときと比べて、固定接点の表面側で高密度化して、接点間に発生したアークに強い駆動力を与えて、高速度でアークを走行させることができる。

【0121】請求項18記載のものは、請求項17記載のものの効果に加えて、磁性片が略し字型に形成されたから、L字型の一片が固定接点板の固定接点に対する反対側に当接すると、定格電流の通電状態で発生する熱を発散して、固定接点を冷却し長寿命化できるとともに、一片と他片とでもってさらに磁束を高密度化できる。

【0122】請求項19記載のものは、請求項17記載のものの効果に加えて、磁性片がコ字型内部に位置して形成されたから、L字型の磁性片の一片と他片との両方がコ字型外部へ突出することなく、薄型化を達成することができる。

#### 【図面の簡単な説明】

【図1】本発明の第1実施形態を示す正面図である。

【図2】同上の接点開離直後の正面図である。

【図3】同上の接点開離時の正面図である。

【図4】同上の開離後の正面図である。

【図5】同上の斜視図である。

【図6】同上の回路遮断器への組立図である。

【図7】同上の第2対向片が複数部材である状態の斜視図である。

【図8】本発明の第2実施形態を示す正面図である。

【図9】同上の斜視図である。

【図10】同上の固定接点板が略平行状態の正面図である。

【図11】本発明の第3実施形態を示す正面図である。

【図12】同上の斜視図である。

【図13】本発明の第4実施形態を示す正面図である。

【図14】本発明の第5実施形態を示す正面図である。

【図15】本発明の第6実施形態を示す斜視図である。

【図16】同上の絶縁物にて被覆状態の斜視図である。

【図17】本発明の第7実施形態を示す斜視図である。

【図18】同上の固定接点におけるアーク膠着位置を表す平面図である。

【図19】同上の膠着アークの伸長状態を表す側面図である。

【図20】同上の別の実施例の斜視図である。

【図2-1】同上の別の実施例の斜視図である。

【図22】同上の固定接点における別のアーク膠着位置を表す平面図である。

【図23】本発明の第8実施形態を示す正面図である。

【図24】同上の斜視図である。

【図25】同上のアーチの伸長状態を表す正面図である。

【図26】同上のアークが伸長し矯絡した状態を表す正面図である。

【図27】同上の別の実施例の正面図である。 44 アーク走行板  
【図28】同上別の実施例の正面図である。 44 a 切り欠き部

【図29】本発明の第9実施形態を示す斜視図である。 5 絶縁物

【図3-0】同上の固定端子板のまわりに発生す

【図9-6】内柱の固定端を嵌り部材に充て、その外側に壁面をもつて構成する構造を複合壁面とする。

【図2-1】従来例を示す斜視圖である。

【図3-1】従来例を示す斜視図である。

【図3-2】同上の回路遮断器への組立図である。

## 【符号の説明】

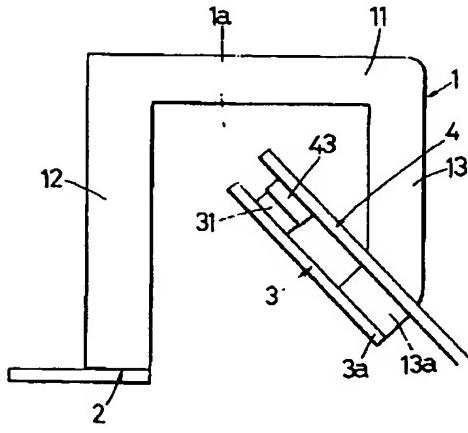
## 1 コイル

1 a ノ字型

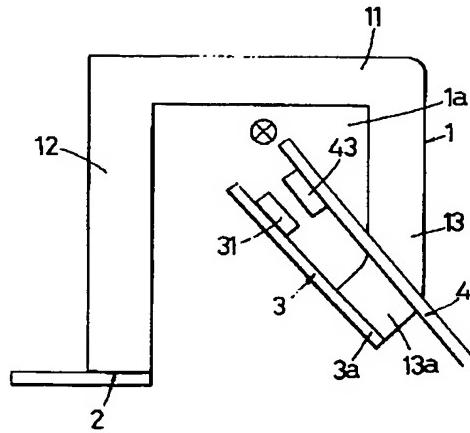
- 1 1 中央片  
1 2 第1対向片  
1 3 第2対向片

- |       |         |
|-------|---------|
| 1 3 a | 先端      |
| 2     | 端子板     |
| 3     | 固定接点板   |
| 3 a   | 基端部     |
| 3 1   | 固定接点    |
| 3 1 a | 空間      |
| 3 1 b | アーク膠着位置 |
| 3 2   | 中間片     |
| 3 3   | アーク走行板  |
| 3 3 a | 切り欠き部   |
| 4     | 可動接点板   |
| 4 2   | 回動軸     |
| 4 3   | 可動接点    |
| 4 3 a | アーク膠着位置 |
| 4 4   | アーク走行板  |
| 4 4 a | 切り欠き部   |
| 5     | 絶縁物     |
| 6     | 固定壁     |
| 7     | 遮蔽壁     |
| 7 1   | 通気路     |
| 7 a   | 操作ハンドル  |
| 8     | 隔壁      |
| 8 1   | 第1空隙    |
| 8 2   | 第2空隙    |
| 9     | 磁性片     |
| 9 1   | 一片      |

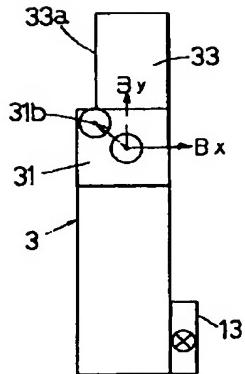
【図1】



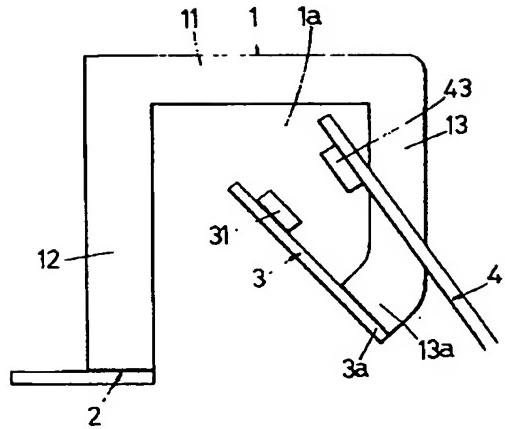
【図2】



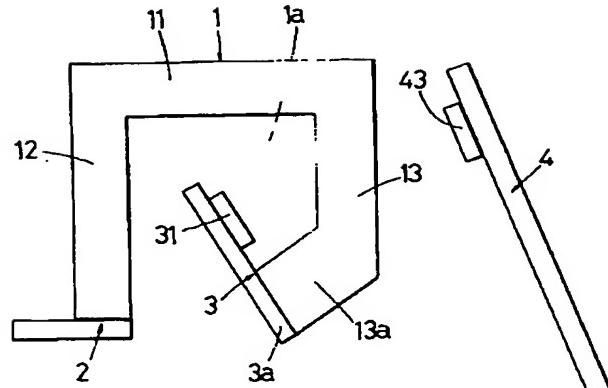
【图18】



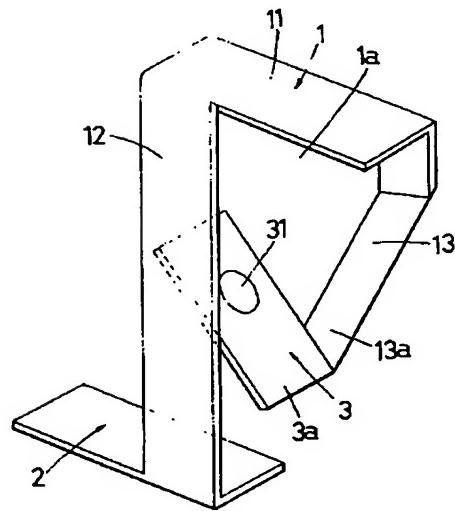
【図3】



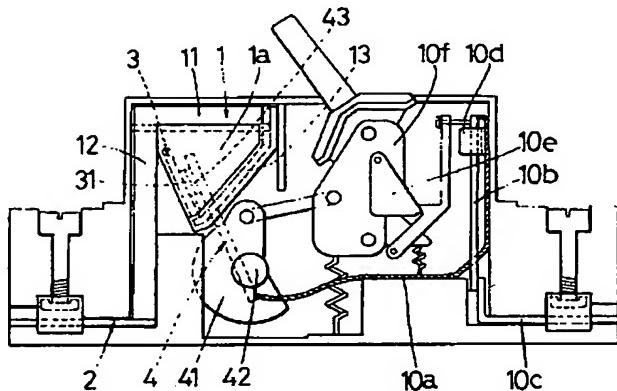
【図4】



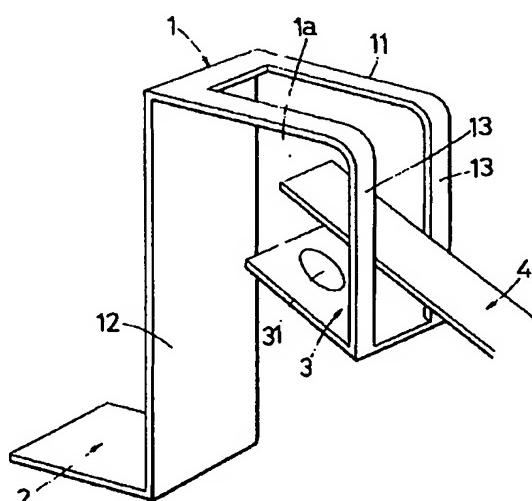
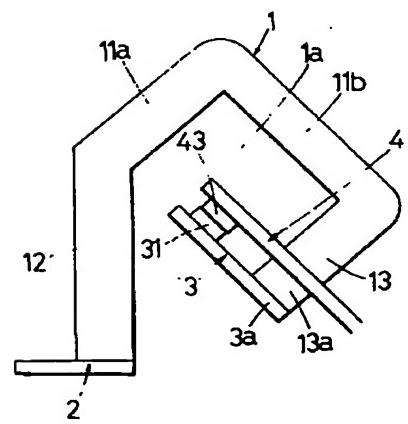
【図5】



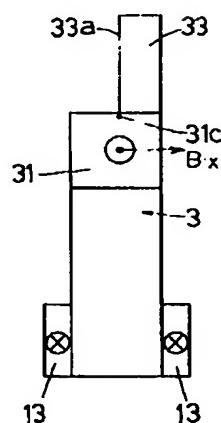
【図6】



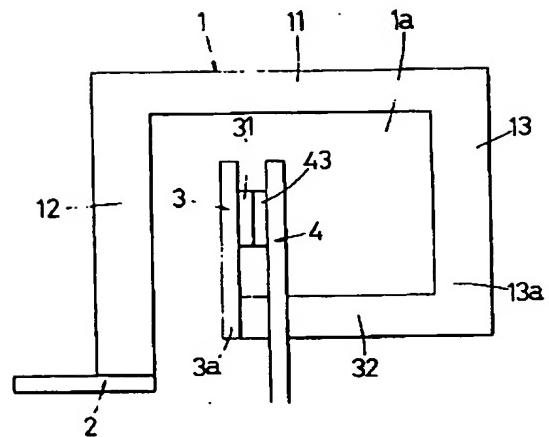
【図11】



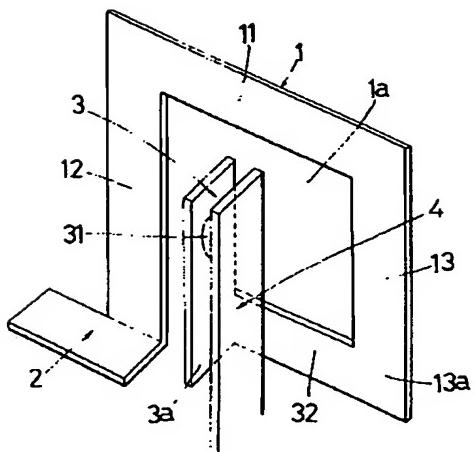
【図22】



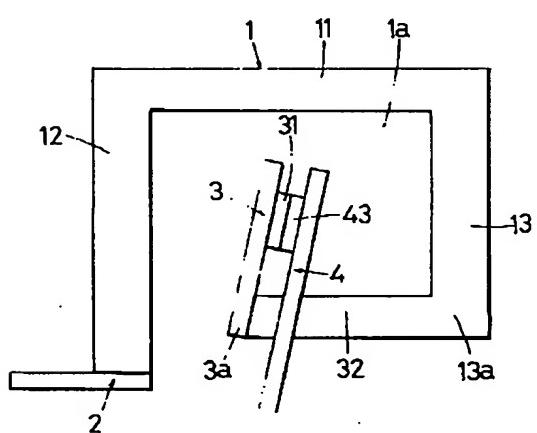
【図8】



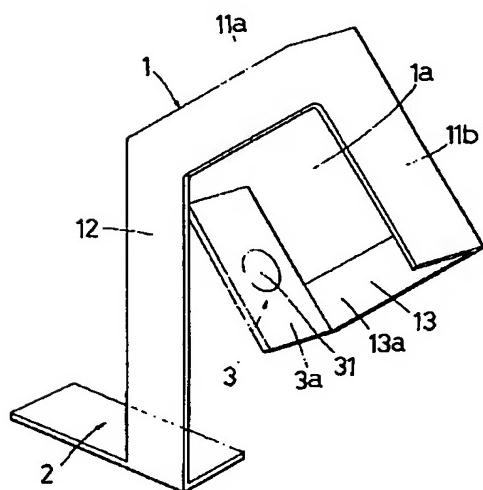
【図9】



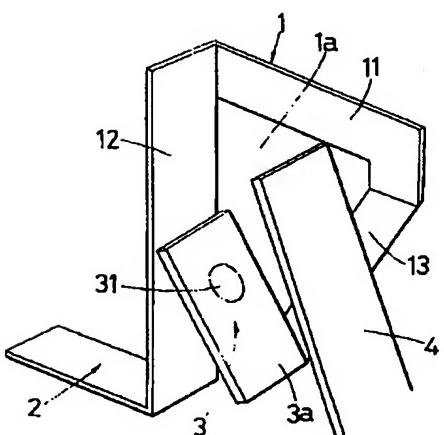
【図10】



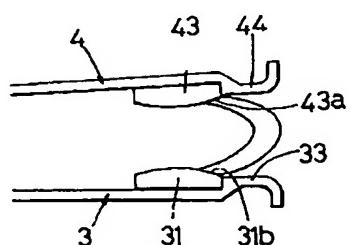
【図12】



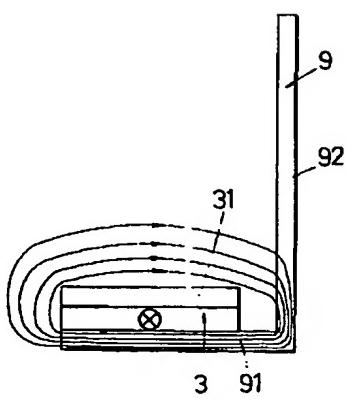
【図13】



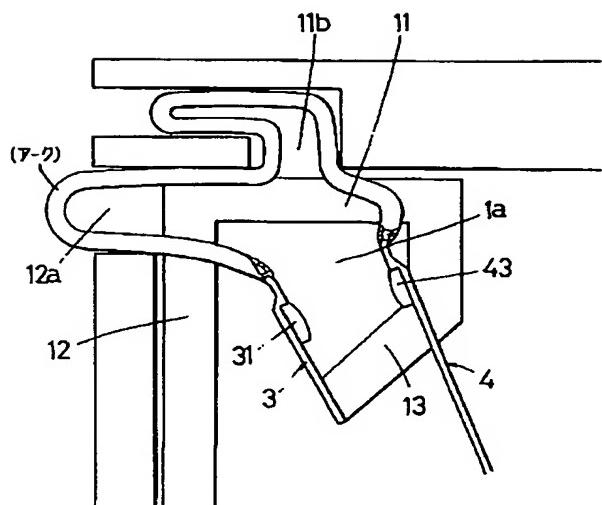
【図19】



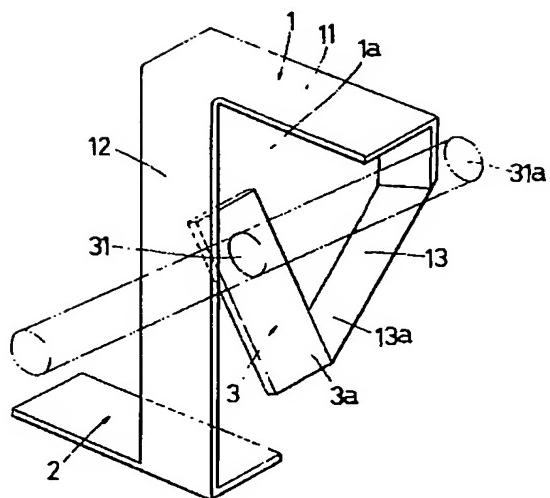
【図30】



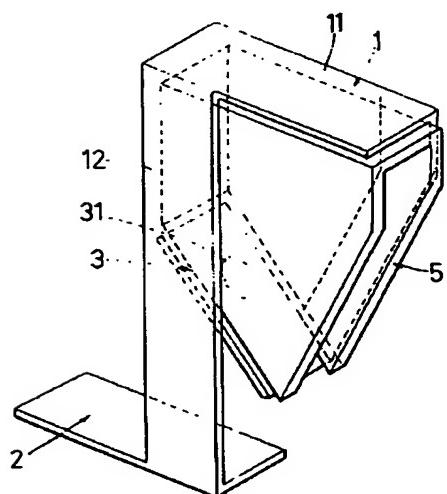
【図14】



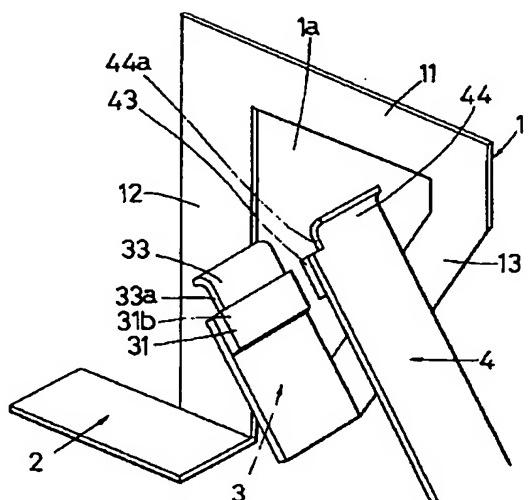
【図15】



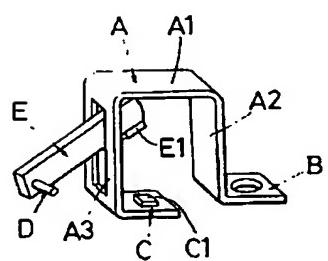
【図16】



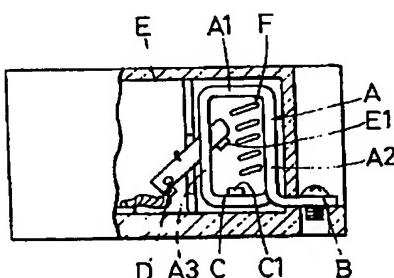
【図17】



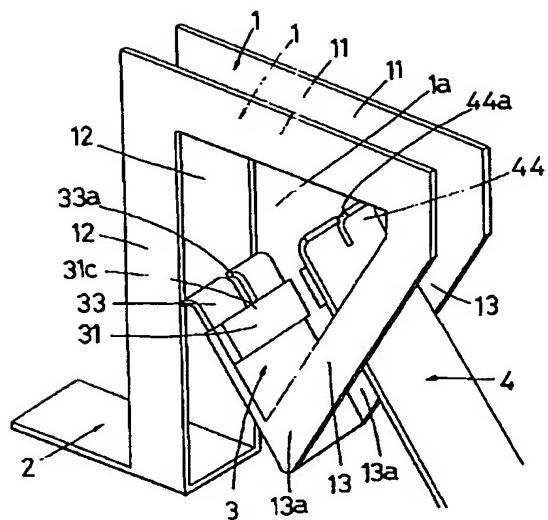
【図31】



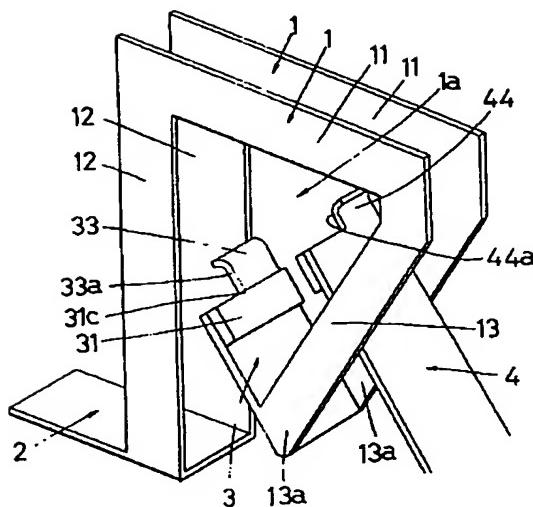
【図32】



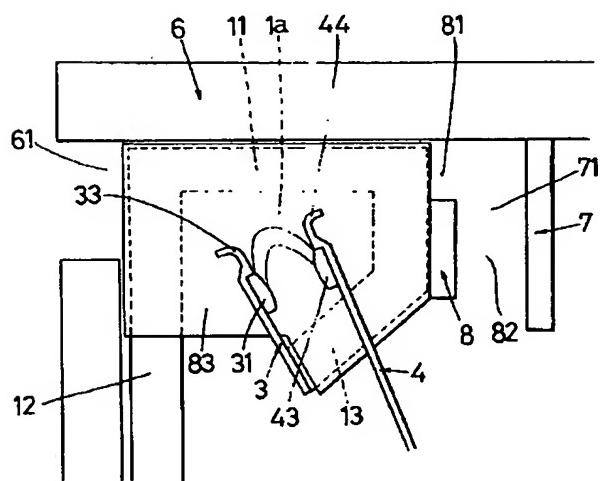
【図20】



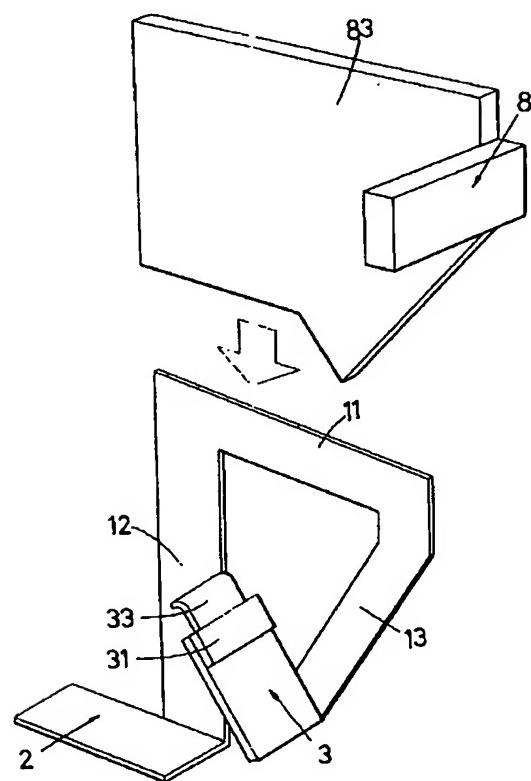
【図21】



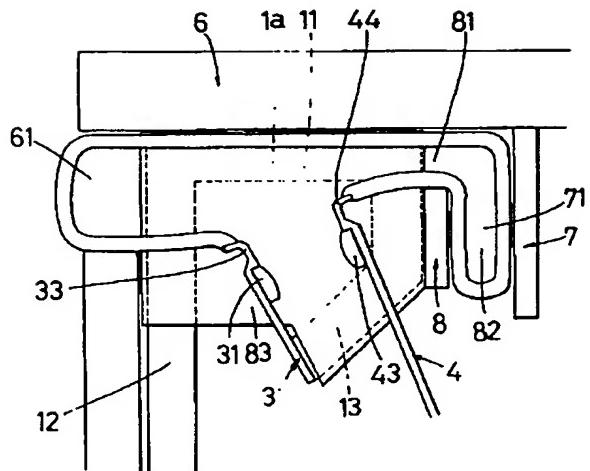
【図23】



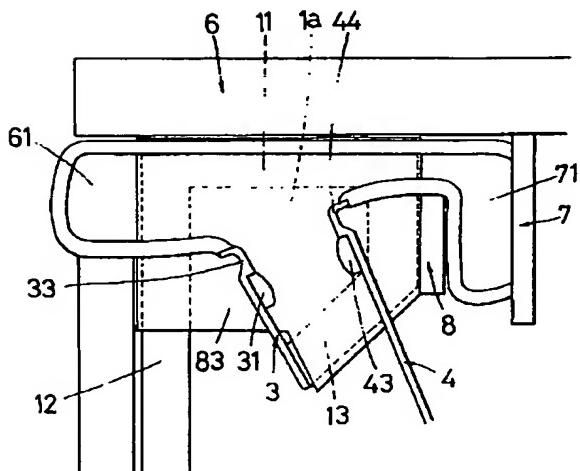
【図24】



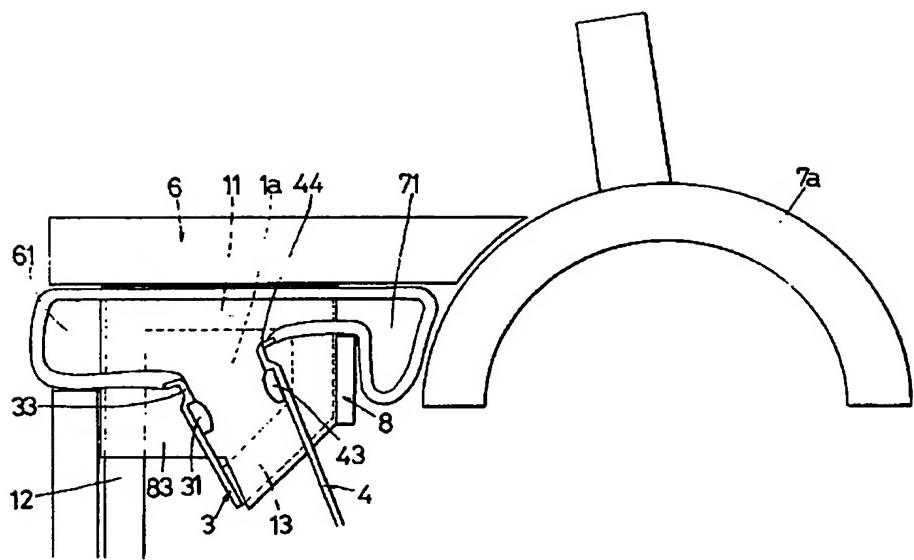
【図25】



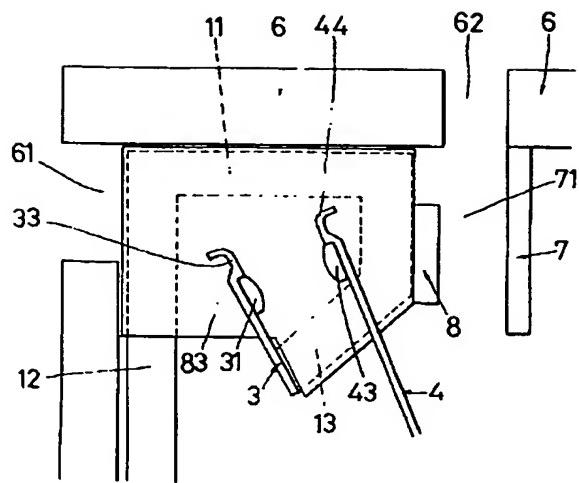
【図26】



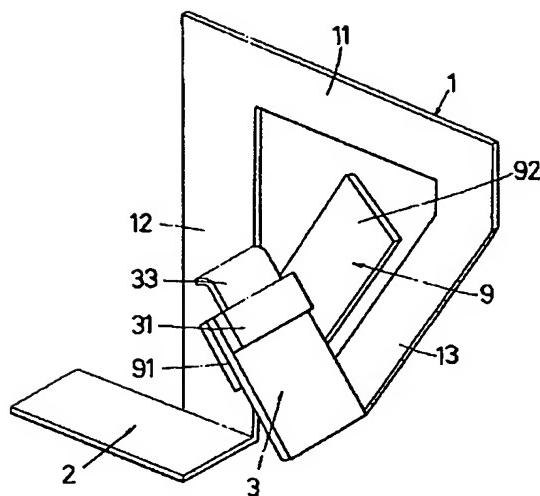
【図27】



【図28】



【図29】



フロントページの続き

(72)発明者 香川 卓也  
大阪府門真市大字門真1048番地松下電工株  
式会社内